

ABSTRACTS

ABSTRACTS FOR THE 2008 NAEMSP SCIENTIFIC ASSEMBLY

1. BYSTANDER ADMINISTERED AED SHOCK IMPROVES SURVIVAL FROM OUT OF HOSPITAL CARDIAC ARREST IN US AND CANADA **Myron L. Weisfeldt, Colleen Griffith, Tom P. Aufderheide, Daniel P. Davis, Jonathan Dreyer, Erik P. Hess, Jonathan Jui, Alexander MacQuarrie, Justin P. Maloney, Laurie J. Morrison,** *Johns Hopkins University School of Medicine, Baltimore, MD, United States of America*

Introduction. The Public Access Defibrillation (PAD) trial showed that training and equipping lay volunteers to use an automated external defibrillator (AED) in community settings doubled the number of survivors after out-of-hospital cardiac arrest (OOHCA) compared to training in cardiopulmonary resuscitation (CPR) alone. The effectiveness of contemporary community-based PAD programs is unknown. **Hypotheses.** Bystander defibrillation before arrival of emergency medical services (EMS) personnel improves survival. **Methods.** Design-Population-based cohort study. Setting-11 US and Canadian urban and rural sites participating in the ROC, a prehospital emergency care trials network. Inclusions-Individuals with non-traumatic OOHCA from December 1, 2005 to November 30, 2006, evaluated by organized EMS personnel who received attempted defibrillation before or after EMS arrival or chest compressions by EMS. Analyses-Multivariate logistic regression assessed the association between PAD and survival to hospital discharge. **Results.** Of 9,897 EMS-treated OOHCA, 2991 (30.4%) received bystander CPR and 249 (2.5%) had AED placed by bystander. Overall survival to hospital discharge was 7%. Survival with bystander CPR but no AED, 8%; with AED applied by a bystander 21%; with bystander AED shock delivered, 33%; with EMS shock only, 15%. AED was applied by Lay Volunteers (32%), Police (24%), Healthcare Workers (42%), or Unknown (2%). The association between AED application and survival to hospital discharge was adjusted for age, gender, bystander CPR, public location, EMS response

time and bystander witnessed status using multivariate logistic regression. After controlling for these factors, AED application was significantly associated with survival (O.R. 2.21, 95% CI: 1.41–3.47, $p < 0.001$). **Conclusions.** Survival benefits demonstrated in the PAD trial can translate to improved survival in community-based programs. Extrapolating this greater survival from ROC population base (20 million) to the population of US and Canada (330 million) suggests that currently AED application by bystanders saves 412 lives per year. Contemporary PAD programs have a substantial impact on survival from cardiac arrest but impact may be limited by penetration of PAD into the community.

2. A UNIVERSAL TERMINATION OF RESUSCITATION CLINICAL PREDICTION RULE FOR BOTH ADVANCED AND BASIC LIFE SUPPORT PROVIDERS **Laurie J. Morrison, Katherine S. Allan, Cathy Zhan, Alex Kiss, P. Richard Verbeek,** *Prehospital and Transport Medicine Research, University of Toronto, Toronto, Ontario, Canada*

Background. Distinct termination of resuscitation (TOR) rules have been retrospectively derived for advanced life support (ALS) providers and prospectively validated for basic life support (BLS) providers. We sought to validate each TOR rule on a prospectively collected cohort of out of hospital cardiac arrest (OHCA) patients attended by both levels of providers to determine whether either of these rules could stand as a universal prehospital TOR rule. **Methods.** We performed a secondary cohort analysis of data prospectively collected for the Resuscitation Outcomes Consortium Epistry trial from April 1, 2006, to March 31, 2007. This included a prospective cohort study of all prehospital cardiac arrest patients attended by either BLS or ALS providers within 7 regional EMS systems. The BLS and ALS TOR rules were applied and diagnostic test characteristics for each rule were calculated including sensitivity, specificity, positive predictive value, negative predictive value and the predicted transport rate. **Results.** Both TOR rules were applied against 2410 patients with presumed cardiac etiology OHCA. The ALS TOR rule recommended TOR for 744 patients and

none of these patients survived. The ALS TOR rule had a specificity of 100% for recommending transport of potential survivors and had a positive predictive value of 100% for death when TOR was recommended. Implementation of the ALS TOR rule would result in a transport rate of 69%. The BLS TOR rule recommended TOR for 1306 patients and none survived. The BLS TOR rule had a specificity of 100% for recommending transport of potential survivors and had a positive predictive value of 100% for death when TOR was recommended. Implementation of the BLS rule would result in a transport rate of 46%. **Conclusions.** Both TOR rules have high specificity and positive predictive values when TOR was recommended. Implementing the BLS TOR rule for all providers would result in a lower overall transport rate without missing any survivors. These findings may be useful for EMS systems who wish to implement TOR procedures for prehospital cardiac arrest patients attended by either ALS or BLS providers and would result in a significant reduction in the transport rate of patients.

3. ETHYL PYRUVATE ENHANCES CORONARY PERFUSION PRESSURES DURING CPR AND MEAN ARTERIAL BLOOD PRESSURE FOLLOWING RETURN OF CIRCULATION **Brian P. Suffoletto, Eric Logue, David Salcido, Lawrence D. Sherman, James J. Menegazzi, University of Pittsburgh, Pittsburgh, PA, United States of America**

Introduction. Elevated myocardial perfusion prior to defibrillation, primarily through the use of epinephrine, is associated with return of spontaneous circulation (ROSC), but often at the expense of blood pressure lability following ROSC. Pyruvate, an antioxidant and metabolic fuel, has been shown to enhance cardiac energy reserves and antioxidant defenses after ROSC. **Objective.** To examine the effects of ethyl pyruvate (EP) on coronary perfusion pressure (CPP) during CPR, number of rescue shocks, time to hypotension ($MAP \leq 65$ mmHg), post-resuscitation vasopressor requirements, and survival. **Methods.** We induced VF in seventeen mixed-breed swine through transcutaneous shock and left them untreated for 8 minutes. After 8 minutes of VF, CPR was begun using a mechanical chest compression device (LUCAS, Sweden) which gave compressions at a rate of 100 per minute, at a depth of 5 cm in the antero-posterior position, and a duty cycle of 50%. At the onset of CPR animals were randomly assigned to treatment with either 25 mL/kg of Ringer's solution or 25 mL/kg of Ringer's solution containing 40 mg/kg of ethyl pyruvate, infused over 5 minutes. After 2 minutes of CPR (minute 10 of VF) we gave epinephrine (0.10 mg/kg), vasopressin (40U) and propranolol (0.1 mg/kg). CPR continued and the first rescue shock was delivered at minute 13 of VF. All shocks

were 150J biphasic waveform defibrillations. Animals having ROSC were supported with standardized care for 2 hours. All baseline and experimental variables were compared using the Mann-Whitney U test. CPP data and norepinephrine dose were analyzed using repeated measures analysis of variance (RMANOVA). **Results.** Both groups had 100% ROSC and 100% 2-hour survival. The EP group exhibited higher CPP (38.4 ± 7.0) than the control group (28.6 ± 8.5) by 4 minutes of CPR. ($p = 0.02$) The median (IQR) time to hypotension following ROSC was 9.64 minutes (8.7–12.3) in the EP group and 7.25 minutes (6.6–9.33) in controls ($p = 0.04$). By 60 minutes post-ROSC, the total dose of norepinephrine needed to maintain MAP between 65 and 85 mmHg was 1.35 ± 0.5 g in EP group versus 2.3 ± 0.9 g in controls. **Conclusions.** The administration of EP with CPR significantly improved physiologic components of the resuscitation and post-resuscitation period.

4. THE NON-INVASIVE CARBOXYHEMOGLOBIN MONITORING OF FIREFIGHTERS ENGAGED IN FIRE SUPPRESSION AND OVERHAUL OPERATIONS **Edward Thomas Dickinson, C. Crawford Mechem, Stephen R. Thom, Frances S. Shofer, Roger A. Band, University of Pennsylvania, Philadelphia, PA, United States of America**

Purpose. It has become increasingly evident that firefighters are at risk for both acute and chronic exposure to chemical asphyxiants produced by the combustion of building materials, including carbon monoxide gas. In general, firefighters are protected from the effects of these gases by wearing self-contained breathing apparatus (SCBA). However, during the overhaul operations that follow fire suppression, firefighters often remove their SCBA when the environment appears to be smoke free. The purpose of this study was to determine the real time carboxyhemoglobin (COHgb) levels of firefighters with and without the use of self contained breathing apparatus (SCBA) as they were engaged in various fire suppression duties in live fire training exercises. **Methods.** This was a prospective, single group repeated measures sample design study. Data was collected using a finger probe non-invasive CO-oximeter device that obtained carboxyhemoglobin levels at baseline, on SCBA during fire suppression activities and off of SCBA during overhaul operations. COHgb levels obtained by this device are referred to SpCO. Statistical analysis of firefighter SpCO data was accomplished utilizing analysis of variance in repeated measures. **Results.** Three full sets of SpCO data were collected on eighteen firefighters ranging in age from 18 to 51 with a mean age of 25.3 years. The SpCO levels of firefighters off SCBA during overhaul operations (mean SpCO 6.1% \pm 3.3) were significantly higher when compared to the baseline levels (mean SpCO 3.1% \pm 1.9) or the levels on SCBA

during fire suppression (mean SpCO 2.8% \pm 2.0), ($p < 0.0001$) for both comparisons. **Conclusions.** In the setting of overhaul-like operations, firefighters who were working without the protection of SCBA developed elevated and potentially harmful levels of CO-Hgb. Standards that mandate the use of SCBA during all portions of interior structural firefighting including overhaul operations should be uniformly adopted and enforced by fire departments to help insure the health and safety of firefighters.

5. THE IMPACT OF THE GERIATRICS EDUCATION FOR EMS TRAINING PROGRAM IN A RURAL COMMUNITY **Manish N. Shah, Karthik Rajasekaran, William D. Sheahan, III, Tracy Wimbush, Jurgis Karuza, University of Rochester, Rochester, NY, United States of America**

Objective. To evaluate the impact of the Geriatrics Education for EMS (GEMS) course on EMS providers in a rural county. We hypothesized that the course would encourage EMS providers to have friendlier attitudes towards older adults and would result in greater provider comfort in caring for older adults. **Methods.** A prospective cohort study using a pre-/post- survey of EMS providers taking the GEMS basic life support course in Livingston County, NY was performed. For courses taught between October 2005 and May 2007, a pre-course survey was administered to assess EMS providers' attitudes toward older adults (UCLA Geriatric Attitude Scale, total score 14–70, higher value representing more positive attitudes) and their comfort in caring for older adults. Three months later, subjects were contacted and the survey was re-administered. Survey responses were on a 5-point Likert scale. Descriptive statistics were performed to characterize the EMS providers taking the course and a Wilcoxon ranksum test was performed to compare responses before and three months after the course. **Results.** Eighty-eight EMS providers participated in the study and successfully completed the course. The median age of the EMS provider was 43 (interquartile range (IQR): 36, 58). The median years of EMS experience was 8 (IQR 2, 18). Forty-five (51%) were female; 69 (78%) were basic life support trained; and 13 (15%) reported EMS as their primary job. Sixty-two (70%) participants reported caring for less than 5 patients per week. All subjects passed the course. Follow up was completed on 77 (80%). The median pre-class attitude score was 54/70 (IQR 51, 58) and post-class score was 56/70 (IQR: 52, 59). This change was not significant ($p = 0.09$). Median comfort scores significantly increased for the following domains: communications, medical care, abuse evaluation, falls evaluation. No significant change was found for the following domains: trauma care, end of life care, medication interactions. **Conclusions.** Completion of the GEMS course by EMS providers practicing in a rural

community resulted in a statistically significant improvement in provider comfort when caring for older adults. No significant change in attitudes was identified. The impact of the training on patient outcomes needs to be identified.

6. INTERRATER AGREEMENT AMONG EMERGENCY MEDICAL TECHNICIANS USING THE AVPU SCALE **Eli Segal, David Zlotnick, Marc Afilalo, Urgences-sante, Montreal, Quebec, Canada**

Introduction. Emergency medical technicians (EMTs) use the AVPU scale to classify patients into one of four levels of mental alertness: (A)lert, responsive to (V)erbal stimulus, responsive to (P)ainful stimulus, or (U)nresponsive. The AVPU level is an integral part of the initial evaluation of the patient, and serves as one of the key factors in patient care protocols. However, the reproducibility of the AVPU scale itself has not been well studied, and it is unclear if there is variability in its application. **Objective.** The objective of this study is to evaluate the interrater agreement of the AVPU scale between EMTs. **Methods.** Twenty-one simulated patient encounters were videotaped using volunteers and scripted scenarios. A convenience sample of Basic Life Support-Defibrillator trained EMTs was invited to participate in the survey. EMTs viewed each vignette and evaluated the simulated patient's mental status using the AVPU scale. Data was recorded in an electronic database. EMTs entered the data without assistance from research assistants, and were instructed to use their past experience and training to interpret the AVPU level. The primary outcome was the chance-corrected agreement, expressed as a multi-rater kappa score. Secondary outcome measures included the association of agreement and amount of initial training (150, 336 or >800 hours) or years of experience working as a paramedic. **Results.** 20 EMTs participated in the study, and 19 completed all the vignettes. No paramedic refused to participate. There was substantial agreement between EMTs for the overall score (Kappa = 0.71, 95% CI: 0.69–0.73, $p < 0.0001$). Agreement was highest for the U score (Kappa = 0.88, 95% CI: 0.85–0.91) followed by P (Kappa = 0.71, 95% CI: 0.68–0.75), A (Kappa = 0.71, 95% CI: 0.67–0.74) and V (Kappa = 0.54, 95% CI: 0.51–0.57). EMTs with more initial training (>800 and 336 hours vs. 150 hours) had a significant trend toward greater agreement ($p = 0.0347$), however no significant association was noted between level of agreement and years experience. **Conclusion.** Using simulated patient encounters, paramedics displayed substantial agreement using the AVPU score, with less variability at the extremes of the scale. This level of agreement suggests that the AVPU score is highly reproducible between observers, and should be considered a reliable test for EMS use.

7. TRANSMISSION OF 12-LEAD ECG TRACINGS BY EMT-BASICS AND EMT-INTERMEDIATES: A FEASIBILITY STUDY **Brad Cotton, Robert E. Newland, Howard A. Werman** *EMS Medical Director, Ross County, Ohio, Chillicothe, OH, United States of America*

Introduction. Early treatment using percutaneous cardiac intervention (PCI) has emerged as the superior treatment strategy for patients with ST elevation MI (STEMI). Prehospital transmission of the electrocardiogram (ECG) in STEMI patients has been shown to reduce door to treatment time. Acquisition of the ECG tracing is a paramedic skill, thus limiting the benefit of early ECG transmission to primarily urban areas. The purpose of this investigation was to determine whether prehospital ECG's could be transmitted by non-paramedic personnel and whether transmitted ECG's could reduce drug to balloon time. **Methods.** Fifty five rural volunteer EMT's underwent formal training in the acquisition and transmission of the ECG. A prospective unblinded case series of consecutive patients with a chief complaint of chest pain was conducted. An ECG was obtained on all eligible patients. Proper lead placement was verified on emergency department arrival by appropriately trained staff. The diagnostic quality of the ECG was assessed by the receiving cardiologist or emergency physician. Time on scene, time to catheterization lab and time to angioplasty, where appropriate, were recorded. These times were compared to all other STEMI patients treated with PCI. **Results.** Ninety patients were enrolled in the study. The average on-scene time for all patients was 18.3 + 7.3 minutes with an average time to ECG transmission of 11.7 minutes. An ECG was transmitted successfully in 89 of 90 patients (98.9%). Accurate lead placement was noted in 89 of 90 (98.9%) and the ECG was of 'diagnostic quality' in 85/89 patients (95.5%). For the 4 patients with STEMI with prehospital ECGs, the average door to cath time was 36 minutes and average door to balloon time was 68 minutes compared to 74 and 99 minutes, respectively, for other PCI's performed during that period. **Conclusions.** We conclude that prehospital transmission of diagnostic-quality ECG can be reliably performed by non-paramedic providers. Pilot data suggests that ECG transmission may potentially impact door to balloon time for STEMI patients in a rural setting.

8. THE INCIDENCE OF PULMONARY ASPIRATION ASSOCIATED WITH LARYNGEAL MASK AIRWAY (LMA) USE DURING CARDIOPULMONARY RESUSCITATION (CPR) AND POSITIVE PRESSURE VENTILATION (PPV) IN SWINE **Brian P. Suffoletto, Eric Logue, David Salcido, James J. Menegazzi,** *University of Pittsburgh, Pittsburgh, PA, United States of America*

Background. Pulmonary aspiration of gastric contents occurs 20–30% of the time during resuscitation from cardiac arrest from loss of protective airway reflexes and pressure changes generated during CPR and PPV. Even though the American Heart Association (AHA) has recommended the LMA as an acceptable alternative airway for use, concerns over the capacity of the device to protect from pulmonary aspiration remain. **Objective.** To assess the incidence of aspiration after LMA placement, CPR and PPV. **Methods.** Prospective study on 16 post-experimental mixed-breed domestic swine of either sex. A standard size-4 LMA was modified so that a vacuum Catheter could be advanced into and past the diaphragm. It was placed into the hypopharynx and confirmed using End-tidal CO₂. Fifteen milliliters of heparinized blood were instilled into the pharynx and after 5 PPVs with a mechanical ventilator, chest compressions were performed for 60s with asynchronous ventilations at a rate of 12 per minute. After chest compressions, a suction catheter was inserted through the cuff and applied for 1 minute. The catheter was removed and inspected for signs of blood. The LMA was removed, the intima of the LMA diaphragm was inspected for signs of blood. In a validation cohort of 4 animals, the LMA was replaced, a cricothyrotomy performed and 5 mL of blood instilled into the trachea. **Results.** There were 0/16 (95% CI: 0–5.3) with a positive tests for the presence of blood in both vacuum catheter and intima of the LMA diaphragm. In the validation cohort, all four were positive for blood in both vacuum catheter and the intima of the LMA diaphragm. **Conclusions.** In our model of regurgitation of gastric content after LMA placement, there was no sign of pulmonary aspiration. Future studies should determine the frequency of pulmonary aspiration after LMA placement in the human model.

9. MILD HYPOTHERMIA SLOWS THE DECAY OF QUANTITATIVE VENTRICULAR FIBRILLATION WAVEFORM MORPHOLOGY DURING PROLONGED CARDIAC ARREST **James J. Menegazzi, Jon C. Rittenberger, Brian P. Suffoletto, Eric S. Logue, David D. Salcido, Lawrence D. Sherman,** *University of Pittsburgh, Pittsburgh, PA, United States of America*

Introduction. The benefits of hypothermia in treating ventricular fibrillation (VF) are myriad, but poorly understood. Patients who are found cold by EMS providers are often resuscitated after prolonged cardiac arrest. One contributory mechanism may be the slowing of metabolic processes during VF. **Hypothesis.** We hypothesized that the time-dependent deterioration of the electrocardiographic (ECG) waveform during VF would be slowed by mild hypothermia, when compared to normothermic VF. **Methods.** We randomly

assigned 42 domestic swine (weighing 27.2 ± 2.3 kgs) to either pretreatment with hypothermia before induction of VF ($n = 14$) or normothermic VF ($n = 28$). After induction of anesthesia, animals were instrumented via femoral cutdown. Lead II ECG was recorded continuously. The hypothermia animals were cooled, starting at 5 minutes prior to the induction of VF, with a rapid infusion of ice-cold normal saline (30 mL/kg). Normothermic animals received no additional fluid prior to induction of VF. VF was induced with a 3s, 60 Hz transthoracic shock and was untreated for 8 minutes. We calculated the VF scaling exponent (ScE), a non-linear dynamical measure, q 5s for the entire 8 minute period. Temperatures are reported in degrees C. ScE data were compared using splined generalized estimating equations (GEE). **Results.** The mean temperature at the onset of VF was $34.6 (\pm 0.8)$ for the hypothermia group and $37.8 (\pm 0.8)$ for the normothermia group. The ScE values over time were significantly lower after 3 minutes in the hypothermia group (splined GEE $p = 0.08$ for 0–3 min and $p = 0.004$ for 3–8 min). The mean hypothermia ScE at 8 minutes was 1.32, while the normothermia ScE was 1.52. The mean ScE difference of 0.20 at 8 minutes is clinically meaningful, as the probability of predicting a successful defibrillation at an ScE of 1.30 is 100% sensitive and 76% specific. **Conclusions.** Mild hypothermia slowed the decay of the ECG waveform during prolonged VF and has a beneficial electrophysiological effect during VF.

10. INTRAMYOCARDIAL HIGH-ENERGY PHOSPHATE DELETION DURING VENTRICULAR FIBRILLATION CORRELATES WITH ELECTROCARDIOGRAPHIC CHANGE David D. Salcido, James J. Menegazzi, Eric S. Logue, Brian P. Suffoletto, Lawrence D. Sherman, *University of Pittsburgh, Pittsburgh, PA, United States of America*

Background. Ventricular fibrillation (VF) is highly energy-wasteful, producing no perfusion. High-energy phosphates (HEPs) deplete rapidly during VF, and may adversely affect the organization of VF. We have shown that the scaling exponent (ScE) of the VF waveform correlates with rescue shock outcome and can be used to guide decision-making during CPR. **Hypotheses.** We hypothesized that intramyocardial HEPs would rapidly diminish during untreated VF, and that this decrease would correlate with changes in the ScE. **Methods.** We anesthetized and instrumented 18 domestic swine (weighing 26.6 ± 1.9 kg). We systematically assigned them (6 per group) to 5, 10, or 15 minutes of untreated VF, which was induced with a transthoracic shock. At the predetermined timepoint open-chest biopsies were taken from the left ventricle. Biopsied tissue samples were immediately flash frozen in a slurry of dry ice and isopentane (-90° C), and HEPs were extracted with 1% trichloroacetic acid. Lev-

els of ATP and ADP were measured luminometrically by an ADP/ATP ratio kit. ATP and ADP levels were assayed in duplicate, and the average recorded (reported in nmol/mg myocardial tissue). Fifteen seconds of ECG signal were digitally recorded (for ScE analysis) immediately prior to biopsy. ScE values were paired with ATP and ADP for calculation of linear regression. HEPs vs. time were compared with ANOVA. **Results.** Mean ATP/ADP were 1.20/0.21 at 5 min, 0.94/0.12 at 10 min, and 0.45/0.11 at 15 min. ATP correlated with ScE ($r = .63$, $p = 0.009$) but ADP did not ($r = .35$, $p = 0.17$). Both ATP ($p = 0.004$) and ADP ($p = 0.024$) differed over time. **Conclusions.** HEPs rapidly diminish during untreated VF. ATP depletion correlates with ScE change.

11. AN INDEPENDENT EVALUATION OF AN IMPEDANCE THRESHOLD DEVICE'S EFFECT ON RESUSCITATION FROM PORCINE VENTRICULAR FIBRILLATION Timothy J. Mader, Adam R. Kellogg, Jeremy Smith, Racheal Hynds-Decoteau, Claudia Gaudet, John Caron, Brett Murphy, Allie Paquette *Baystate Medical Center/Tufts University School of Medicine, Springfield, MA, United States of America*

Background. An impedance threshold device (ITD) has been designed to enhance circulation by creating a negative intrathoracic pressure to augment venous return during CPR. A recent study suggests that the ITD does not improve hemodynamics and that it may actually worsen outcomes. We sought to independently assess the effect of the ITD on coronary perfusion pressure (CPP) and passive ventilation (PaCO₂ & PaO₂) during standard CPR (S-CPR), and its impact on return of spontaneous circulation (ROSC) and short-term survival in a blinded fashion. We hypothesized that the active ITD would increase the CPP compared to a sham device but cause CO₂ retention and hypoxemia resulting in lower ROSC and survival rates. **Methods.** A lot of 30 identical prenumbered devices (15 active ITD/15 sham ITD) were purchased from the Resuscitation Outcomes Consortium (ROC). The ROC data-coordinating center served as an intermediary to independently control the blinding process. Thirty male swine were instrumented under anesthesia. Ventricular fibrillation (VF) was electrically induced. CPP was continuously recorded. After 8 minutes of untreated VF, baseline characteristics were documented and S-CPR initiated. After three cycles of S-CPR, an ABG was drawn and drugs were given. Following 6 additional cycles of S-CPR, an ABG was drawn and the first rescue shock (RS) was delivered. All animals with ROSC were provided standardized post-resuscitation care. Group comparisons were assessed using descriptive statistics. Proportions with 95% confidence intervals were calculated for outcomes. **Results.** Baseline characteristics and chemistries between the two groups before VF induction and at 8 minutes of

non-treatment were the same. The mean CPP in the ITD group prior to the first RS was 51.2 [95% CI: 37.7–64.7] mmHg compared to 50.2 [95% CI: 37.0–63.4] mmHg in the sham group. The PaCO₂ and PaO₂ were 68 [95% CI: 55.7–79.5] torr and 103 [95% CI: 76–129] torr in the ITD group and 59 [95% CI: 49.1–68.5] torr and 137 [95% CI: 83–191] torr in the sham group. The rate of ROSC was 14/15 in both groups and 13 animals in each groups survived. **Conclusions.** In this independent blinded study, use of the active ITD had no significant impact on CPP, passive ventilation, or outcomes compared to the sham device.

12. INCREASING CPR DURATION PRIOR TO FIRST DEFIBRILLATION DOES NOT IMPROVE ROSC OR SURVIVAL IN A SWINE MODEL OF PROLONGED VENTRICULAR FIBRILLATION Jon C. Rittenberger, Brian Suffolletto, David Salcido, Eric Logue, James J. Menegazzi, University of Pittsburgh, Pittsburgh, PA, United States of America

Introduction. The optimum duration of cardiopulmonary resuscitation (CPR) prior to first rescue shock is not known. Clinical trials have used 90 seconds and 180 seconds. Neither of these durations may be optimal. We sought to determine the optimum duration of CPR prior to the first defibrillation attempt and whether this varied depending on the duration of ventricular fibrillation (VF). In this porcine model of basic life support, our outcomes were rates of return of spontaneous circulation (ROSC), survival, and coronary perfusion pressure (CPP). **Methods.** We anesthetized and instrumented 45 swine and then induced VF. After 5 or 8 minutes of untreated VF, we randomized the swine to mechanical CPR for 90, 180, or 300s. A single rescue shock (150J biphasic) was then administered. If this shock failed, 2 minutes of mechanical CPR were completed prior to the next rescue shock. CPP was calculated for each 30-second epoch. ROSC was defined as a blood pressure >80 mmHg sustained for 60s. Survival was defined as sustained ROSC for 20 minutes. Data were analyzed with Fisher's exact test and ANOVA. **Results.** In the 5-minute VF group, the rate of ROSC did not differ between the three groups (90s: 25%; 180s: 38%; 300s: 38%, $p > 0.05$) Survival rates did not differ (90s: 25%; 180s: 25%; 300s: 25%, $p > 0.05$). In the 8-minute VF group, no animals experienced ROSC or survival. CPP are presented by 30-second epoch in the figure and did not differ between the three groups ($p > 0.05$). CPPs decline after 180s of CPR. **Conclusions.** ROSC and survival were equivalent regardless of VF duration and CPR duration. When CPR begins late, CPPs are low, stressing the importance of early CPR. We do not recommend 300s of CPR unless a defibrillator is unavailable.

13. KING LT VS COMBITUBE: AIR MEDICAL CREW PERFORMANCE AND PREFERENCE Michael Lutes, Elizabeth Tumpach, E. Brooke Lerner, Dennis Ford, Andrews Steven, Medical College of Wisconsin, Wauwatosa, WI, United States of America

Introduction. Air medical personnel are often called upon to manage difficult airways. The Combitube is a supraglottic airway device frequently used by EMS providers as either a primary or rescue airway. We sought to evaluate the performance and preference of a newer supraglottic airway device, the King LT, versus the Combitube in a simulator model. **Methods.** After approval by the IRB, written informed consent was obtained from the study participants. Participants included Emergency Medicine residents serving as flight physicians, flight nurses and flight paramedics in our air medical transport program. Twenty-seven subjects participated. Study design. Participants received a ten minute instructional program describing how to insert each device. The participants then had the opportunity for individual practice with each device. Each participant was then individually tested on the insertion in of each device in a Laerdal SimMan human patient simulator. Rates of successful placement, time to successful placement and practitioner preference were then recorded. Perceived ease of insertion was measured on a 5-point scale. This study was designed to have a statistical power of 80% to detect a difference of insertion time of greater than ten seconds. Twenty-six participants were needed in order to reach to statistical power. **Results.** 27 participants completed the study. All participants correctly placed each device. Mean time to placement for the King LT was 24.4 seconds with a SD of 4.7 seconds. Mean time to placement for the Combitube was 37.9 seconds with a SD of 5.9 seconds. The difference in mean times was 13.5 seconds, SD 4.7 seconds with a 95% CI: 11.6–15.3 seconds. The participant's perceived ease of insertion was recorded on a 5-point scale (1: easy, 5: difficult). Mean score for the King LT was 1.3 vs. 2.5 for the Combitube. Twenty-six of twenty-seven participants preferred the King LT over the Combitube. **Conclusions.** The King LT could be placed significantly faster than the Combitube. The King LT was also perceived as easier to place. Ninety-six percent of participants preferred the King LT. Limitations include using a simulator model rather than a human model.

14. AMBULANCE WAIT TIME DELAYS IN EMERGENCY DEPARTMENTS: A UNIQUE APPROACH TO MEASURING THE PROBLEM Michelle Welsford, Vaughn F. MacDonald, Santo C. Pasqua, Kelly Anne Turner, McMaster University and Hamilton Health Sciences Base Hospital Program, Oakville, Ontario, Canada

Introduction. Delays in offloading patients from ambulance stretchers have become increasingly common across North America. Over-crowded Emergency Departments (EDs) lead to waits for patients on ambulance stretchers and may result in prolonged response times for other emergency medical calls in the community. A collaborative partnership brought together by a community emergency services network, implemented a study to evaluate the feasibility of a swipe-card system to capture wait time intervals while in the ED and to provide real-time access to this data. **Methods.** Card readers with internal clocks were installed in every hospital ED in a city with one ambulance provider. All paramedic crews were given a bar-coded card that identified their vehicle. The paramedic swiped the card at 4 defined times: 1) time of arrival to the ED; 2) time of triage; 3) time of bed assignment; and 4) time of patient transfer to a bed and formal transfer of care. The data for June 2007 were captured and displayed real-time on a password-protected website. In the first month of full usage, data were assessed to determine the paramedic compliance with entering at least the time 1 and time 4 data and the percentage of calls where there was a "wait time delay" (time 4 - time 1). A wait time delay was defined as greater than 30 minutes. **Results.** Paramedics were compliant with using the swipe cards for at least the time of arrival (time 1) and the time of transfer of care (time 4) in 65.9% (1402/2128) of cases in June 2007. The mean (SD) wait time interval of all calls was 23 minutes (26). A wait time delay (>30 minutes) occurred in 385 calls (27.5%). **Conclusions.** A swipe-card system to capture offload intervals in EDs demonstrated feasibility in providing real-time data on wait time intervals. A larger definitive implementation study is possible employing this methodology with interventions aimed at increasing paramedic capture rate of the data and addressing strategies to reducing wait time intervals.

15. COMPARISON OF FENTANYL AND MORPHINE IN THE PREHOSPITAL TREATMENT OF PATIENTS WITH ISCHEMIC TYPE CHEST PAIN **Erin Weldon, Rob Grierson, Rob Ariano, Winnipeg Fire Paramedic Service, University of Manitoba, Winnipeg, Manitoba, Canada**

Objective. In the treatment of acute coronary syndromes reduction of sympathetic stress and catecholamine release is a major therapeutic goal. One method used to achieve this goal is pain reduction through the systemic administration of analgesia. Historically morphine has been the analgesic of choice in ischemic cardiac pain. This study seeks to prove the utility of fentanyl as a first line analgesic for ischemic type chest pain in the prehospital setting. **Methods.** Successive patients who were treated for suspected ischemic chest pain in the emergency medical services system were considered eligible. Once chest pain sug-

gestive of myocardial ischemia was confirmed, patients received oxygen, aspirin, and nitroglycerin therapy. If the ischemic type chest pain continued, despite the aforementioned therapy, the patient was randomized in a double-blinded fashion to treatment with either morphine or fentanyl. Demographic differences, pain scale scores, necessity for additional dosing, and rate of adverse events between the groups were assessed every 5 minutes after randomization and were compared using t-testing, Fisher's Exact test, or ANOVA where appropriate. **Results.** 187 patients were included, with 99 in the morphine group and 88 in the fentanyl group. Baseline characteristics, necessity for additional dosing, and adverse events between the two groups were not statistically different. There were no significant differences between the changes in visual analog scores, and numeric rating scale scores for pain between the two groups ($p = 0.47$ and $p = 0.51$, respectively). In addition, there were no significant differences in MAP, heart rate or respiratory rate for either treatment arm. **Conclusions.** This study demonstrates that fentanyl and morphine are comparable in providing analgesia for ischemic type chest pain. Fentanyl appears to be a safe and effective alternative to morphine for the management of chest pain in the prehospital setting.

16. PREHOSPITAL SEPSIS PROJECT (PSP): KNOWLEDGE AND ATTITUDES OF UNITED STATES ADVANCED OUT-OF-HOSPITAL CARE PROVIDERS **Amado Alejandro Baez, Priscilla Hanudel, Susan Wilcox, Eric Cadin, Ediza Maria Giraldez, Brigham and Women's Hospital/Harvard Medical School, Boston, MA, United States of America**

Introduction. Severe sepsis and septic shock are common and often fatal medical problems. Early interventions in sepsis improve outcomes. The Prehospital Sepsis Project is a multifaceted study that aims to improve the out-of-hospital care of patients with sepsis, by means of knowledge translation and skills enhancement. Our objective was to assess the knowledge and attitudes in the principles of diagnosis and management of sepsis in a cohort of United States out-of-hospital care providers. **Methods.** This was cross sectional study. A 15-item survey was administered via the web and emailed to multiple EMS list-servers. The evaluation consisted of four clinical scenarios as well as questions on the basics of sepsis. For intra-rater reliability the first and the fourth scenarios were identical. Chi-square and Fisher's exact testing were used to assess associations. Relative Risk (RR) was used for strength of association. Statistical significance was set at the 0.05 level. **Results.** A total of 226 advanced EMS providers participated with 85.4% ($N = 193$) completion rate representing 32 different states and consisting of a 30.8% rural, 31.9% urban, and

37.3% suburban mix. From a professional standpoint, 82.2% were paramedics and 70.6% had worked in EMS greater than 10 years. Only 47.67% (92 out of 193) expressed understanding of the differences between the Systemic Inflammatory Response Syndrome (SIRS) and Sepsis. Only 57 (29.53%) participants scored both of the duplicate scenarios correct, and only 19 of the 193 (9.84%) responded to all scenarios correctly. Level of training was not a predictor of correctly scoring scenarios [$p = 0.71$ (RR = 1.25 95%, CI: 0.39–4.01)], nor was years of service [$p = 0.11$ (RR = 1.64, 95% CI = 0.16–1.21)]. Only 64.4% understood the clinical relevance of an elevated lactate level, whereas 73.2% believed that prehospital point of care lactate meters would be helpful to their practice. Additionally, 97.3% agreed that a brief web-based teaching tool would be useful. **Conclusions.** Poor understanding of the principles of diagnosis and management of sepsis was observed in this cohort, suggesting the need for education enhancement. Survey items will be used to develop a focused interactive web-based learning program. Limitations include potential for self-selection and data accuracy.

17. THE RESUSCITATION OUTCOMES CONSORTIUM EPISTRY—FREQUENCY AND VARIABILITY OF ADVANCED AIRWAY MANAGEMENT IN TRAUMA **Mohamud R. Daya, Kent Koprowicz, Aaron Monnig, Dana Zive, Gena Sears, Henry Wang, Craig Newgard, Jeffery Kerby, Oregon Health & Science University, Portland, OR, United States of America**

Purpose. Prehospital airway management is believed to play a critical role in trauma. The purpose of this analysis is to describe the variation in the type and frequency of advanced airway methods within the Resuscitation Outcomes Consortium (ROC) Epistry, a prospective population-based registry of prehospital and hospital trauma data from 11 sites in North America. **Methods.** Prehospital data and outcomes were collected on all patients who suffered blunt, penetrating or burn injury with any one or more of: a) GCS ≤ 12 ; b) SBP ≤ 90 ; c) respirations < 10 or > 29 per minute; or d) a successful advanced airway. Data from all cases between 12/1/05 and 11/30/06 from 10 of the 11 ROC sites were included in this analysis. Advanced airways were limited to oral endotracheal (ETI) or nasotracheal intubation (NTI), supraglottic airway (SGA), and cricothyroidotomy. The advanced airways were not considered to be mutually exclusive. Statistical analysis was performed using counts and percentages for airway methods by site with p-values from chi-square tests of heterogeneity. **Results.** Data from 5,788 EMS treated trauma patients were analyzed. Overall, 1267 (22%) patients received at least one prehospital advanced airway attempt, with an inter-site range of 7–49% ($p < 0.0001$).

The most common advanced airway attempted was ETI, which was used in 1174 (93%) cases. The use of NTI and SGA was unevenly distributed across sites and respectively accounted for 48 (4%) and 75 (6%) all cases ($p < 0.0001$). Two sites accounted for 63% of documented NTI attempts while two other sites accounted for 51% of SGA attempts. Half of the six cricothyroidotomies were performed by one site. **Conclusions.** There is substantial cross-site variation in advanced airway use for major trauma within the ROC. ETI is most commonly reported. Other methods are far less common and unevenly distributed between sites; cricothyroidotomy is rare.

18. PREHOSPITAL EVALUATION OF PARALYTIC ASSISTED ENDOTRACHEAL INTUBATION **W. Andrew Wilson, Thomas Bateman, Vicki Bentzien, Carin M. Van Gelder, Yale-New Haven Hospital, New Haven, CT, United States of America**

Objective. In 2001, a protocol was developed to train paramedics within the state of Hawaii in rapid sequence intubation (RSI). The objective of this study is to evaluate the effectiveness of Honolulu's Emergency Medical Services (EMS) Division training program in RSI. **Methods.** New and veteran Honolulu paramedics completed a 6 hr RSI training component. We performed a retrospective chart review examining patient data who underwent RSI over a 22 month period in Oahu, Hawaii. Included were all patients who underwent RSI and transported to an Emergency Department (ED). Excluded were successfully intubated patients not requiring RSI and non-transported patients (including patients whose resuscitation was terminated in the field). Success rates were evaluated in patients who underwent RSI initially, as well as patients in which endotracheal intubation (ETI) failed on the first attempt but subsequently underwent RSI on their second attempt. Factors pertaining to RSI success and Combitube rescue success were analyzed. Adherence to RSI protocol was factored into success rates. Per state protocol, EtCO₂ devices and SpO₂ monitoring was used to confirm correct tube placement. **Results.** From July 29, 2003 to May 30, 2005, 638 patients underwent RSI in Oahu, Hawaii, by Honolulu paramedics. The success rate of initial RSI was 86.7%. If RSI failed, but a Combitube was used as a rescue device, the success rate increased to 94.7%. Seventy-eight patients out of 638 (12.2%) had a failed ETI attempt initially without RSI medications and subsequently underwent RSI during the second attempt. The success rate of RSI in this population was 88.5%. Trauma patients comprised 17.2% of the patients (110/638) and overall RSI success was 88.2%. Medical patients accounted for 82.8% of the population with overall RSI success rate of 86.4%. Violations of RSI protocol occurred in 1.4% of cases and were not

significant. **Conclusions.** Honolulu paramedics who completed Hawaii's RSI training curriculum accomplished RSI success rates comparable to the national standard. Increasing rescue technique training may decrease the overall percentage of patients who arrive at the ED without a definitive airway.

19. RETROSPECTIVE REVIEW OF AIR MEDICAL NEEDLE THORACOSTOMY **Kristine S. Robinson, Brian W. Moss, Michael J. Leicht, David J. Dula, Geisinger Medical Center, Danville, PA, United States of America**

Introduction. Approximately 2% of trauma patients are reported to have a needle thoracostomy (NT) performed in the pre-hospital setting. While NT is a potentially lifesaving procedure, there is ongoing controversy regarding its indications, efficacy, and safety when performed in the prehospital setting. **Purpose.** The goal of this study is to provide a descriptive analysis of prehospital needle thoracostomy (PHNT) performed by our air medical program. **Methods.** This was a descriptive study involving a retrospective analysis of trauma patient medical records. Patients were identified from a search of our air medical electronic patient care reports screening for PHNTs performed between 1998 and 2005. Records were reviewed in detail for variables including patients' age, sex, mechanism of injury, cardiac arrest, indication for NT, intubation, chest thoracostomy (CT) placement, and survival. **Results.** Of the 8142 trauma patients retrieved by our air medical program from 1998 to 2005, 117 (1.4%) patients had PHNT. The majority of patients (58%) were between 19 and 45 years old, and 78% were male. 77 (66%) were involved in a motor vehicle crash, 10 (8.5%) suffered a gun shot wound, 9 (7.7%) suffered a crush-injury, and 29 (25%) had other mechanisms of injury (e.g., struck-pedestrian, all-terrain vehicle crash, horse injury). 57 (49%) suffered cardiac arrest. 110 (94%) had chest injury. 77 (66%) had coexisting brain injury and 56 (48%) had coexisting abdominal/pelvis injury. 89 (76%) of the cases had documentation of asymmetric breath sounds (BS) or cardiac arrest and a concurrent reason(s) such as hypotension, tracheal deviation, difficult BVM, and difficulty breathing as the indication for performing PHNT. 22 (19%) patients had PHNT due solely to asymmetric BS. 96 (82%) were intubated pre-hospital. 65 (55%) patients survived to ED. 37 (32%) patients survived to discharge; 2 (5%) patients did not receive CT. No complications were noted. In 49% of the cases, a physician accompanied the air medical team. **Conclusions.** PHNTs are not always being performed appropriately in the pre-hospital setting. Patients most likely to undergo PHNT are young men who suffered a serious chest injury. The mortality rate in patients receiving PHNT is high.

20. THE USE OF END-TIDAL CARBON DIOXIDE VALUES OBTAINED DURING BAG-VALVE-MASK VENTILATION TO PREDICT POST-INTUBATION VALUES **Daniel P Davis, James Dunford, University of California-San Diego, San Diego, CA, United States of America**

Background. Capnometry has become an important prehospital tool to confirm endotracheal (ET) tube placement, guide cardiopulmonary resuscitation (CPR), and determine futility in patients with cardiac arrest. While traditionally applied at the time of intubation, use of capnometry with bag-valve-mask (BVM) ventilation may provide important data in non-intubated patients and establish baseline end-tidal CO₂ (EtCO₂) values for ET confirmation. **Objective.** To compare EtCO₂ values obtained during BVM and post-intubation in patients undergoing out-of-hospital intubation or Combitube insertion (CTI). **Methods.** This study was conducted in a large, urban EMS system. A comprehensive airway debriefing program was implemented for 12 months. Paramedics were interviewed immediately by CQI personnel following calls in which invasive airway management was attempted. Patient demographics, vital signs, airway management strategy, clinical course, and EtCO₂ values with BVM and following ET intubation or CTI were recorded. EtCO₂ values with BVM were compared to those obtained following ET intubation using linear regression. The mean difference was also calculated and a histogram used for graphical analysis. **Results.** A total of 221 patients had complete data for analysis; 90% of these were undergoing CPR at the time of airway management. The mean difference between EtCO₂ values obtained during BVM and following intubation was 0.9 mmHg (95% CI: -0.3 mmHg to 2.0 mmHg). The lower quartile value was -4 mmHg, and the upper quartile value was 6 mmHg. Linear regression revealed good correlation between EtCO₂ obtained during BVM and following intubation ($r^2 = 0.55$, $p < 0.0001$). There was no relationship observed between this difference and either use of CTI or multiple intubation attempts. **Conclusions.** EtCO₂ values obtained during BVM appear to accurately predict values obtained following intubation. This is potentially useful to establish a baseline to improve the reliability of capnometry for ET confirmation and may allow for guidance of CPR and determination of futility. We were unable to account for changes in the hemodynamic status of patients. Thus, this analysis likely underestimates the true accuracy of BVM EtCO₂ values. We believe EtCO₂ sensors should be applied during BVM rather than waiting until after intubation.

21. ENDOTRACHEAL TUBE CUFF PRESSURES IN PATIENTS INTUBATED PRIOR TO AEROMEDICAL TRANSPORT **Melissa Shear, Jacob Chapman, Daniel Pallin, John Pliakas, Stephen Thomas, Massachusetts General Hospital, Boston, MA, United States of America**

Background/Purpose. Prolonged endotracheal tube cuff pressures greater than 30 cm H₂O cause complications ranging from sore throat to rare cases of tracheoesophageal fistula. We sought to determine the proportion of patients with over-inflated cuffs in a series of helicopter transports and to determine whether over-inflation was more likely according to physician vs. non-physician intubator, patient gender, and traumatic vs. nontraumatic indication. **Methods.** During June-August 2007, helicopter teams from one air transport service measured cuff pressures upon arriving at the transferring facility or scene, for a convenience sample of patients who had undergone oral endotracheal intubation with cuffed tubes. We use the Kruskal-Wallis test to compare substrata. **Results.** 45 patients aged 7–87 (median 44, interquartile range [IQR] 26–62) were studied; 22 (49%) were male. Trauma was the indication for intubation in 19 (42%), neurological emergencies in 11 (24%), cardiac in 3 (7%), and general medical in 12 (27%). Intubation occurred 1–265 minutes prior to pressure management (median 57, IQR 35–76). Cuff pressure was >30 cm H₂O in 55% and ranged from 14 to 162 (median 33, IQR 27–54). Proportion of over-inflated cuffs did not vary according to physician vs. nonphysician intubator ($p = 0.8$), patient gender ($p = 0.6$), or trauma vs. nontrauma diagnosis ($p = 0.6$). **Conclusions.** More than half of the patients in our series had potentially harmful endotracheal tube cuff pressures. The time required for cuff over-inflation to cause injury is not known, but it seems rational to inflate cuffs to an appropriate level as soon as possible. This suggests that air transport teams should check cuff pressures upon arrival, particularly when air transport may involve decreasing atmospheric pressure. More importantly, checking cuff pressure should become a routine part of the immediate post-intubation assessment.

22. COMPARISON OF THE AIRTRAQ[®] OPTICAL LARYNGOSCOPE TO DIRECT LARYNGOSCOPY BY PARAMEDICS IN A MANIKIN MODEL FOR EASY AND DIFFICULT INTUBATIONS **Thomas A. Nowicki, James C. Suozzi, Mark Dzedzic, Richard Kamin, Stephen Donahue,** *Univ of Connecticut / Hartford Hospital Dept of Emergency Medicine, Hartford, CT, United States of America*

Introduction. Paramedics often encounter patients with difficult airways requiring emergent endotracheal intubation. The purpose of this study was to compare intubation utilizing the Airtraq[®] Optical Laryngoscope with direct laryngoscopy in the manikin model given both normal and difficult airway scenarios. We evaluated the number of attempts, time to successful intubation, and the Airtraq's[®] learning curve. **Methods.** This was a randomized crossover study involving paramedics. Each subject was given a brief lecture followed by a standardized demonstration of the

Airtraq[®] device and a set of instructions regarding its use. Participants were then allowed a 5 minute practice session on a Laerdal Airway Management Trainer[®] with the Airtraq[®] and direct laryngoscopy with a Macintosh #3 blade. Subjects then managed the following scenarios on a Laerdal SimMan[®] manikin: 1) normal airway; 2) tongue edema; 3) c-spine immobilization; 4) normal airway. Results were analyzed using a paired t -test. **Results.** 30 paramedics participated in this study. For Normal airway there were no significant differences in both the number of attempts and time to ventilation. For tongue edema the average time to ventilation using direct laryngoscopy was 171.07s (std dev 34.1) and using the Airtraq[®] was 82.87s (std dev 61.0) with a difference of 88.2s ($p \leq 0.001$). There were no significant differences in time to ventilation for c-spine immobilization. There was a trend for fewer attempts at intubation with the Airtraq[®] ($p = 0.057$). For normal airway the average time to ventilation using direct laryngoscopy was 34.53s (std dev 36.7) and using the Airtraq[®] 18.8s (std dev 5.6) with a difference of 15.73s ($p = 0.018$). Fewer intubation attempts were also observed with use of the Airtraq[®] ($p = 0.02$) for this scenario. Rapid acquisition of skills was also observed with Airtraq[®]. Time to ventilation between scenarios #1 and #4 had a mean difference of 8.4s ($p = 0.001$). **Conclusions.** The Airtraq[®] was shown to be equal or superior to direct laryngoscopy with the Macintosh #3 blade for easy and difficult airway scenarios. The Airtraq[®] has a rapid learning curve demonstrated by significantly decreased time to ventilation at the end of the protocol compared with the beginning.

23. DIAGNOSTIC ACCURACY OF COMPUTERIZED PREHOSPITAL ECG INTERPRETATION IN THE BASIC LIFE SUPPORT SETTING **François de Champlain, Lucy Boothroyd, Eli Segal, Thao Huynh, Viviane Nguyen, Eric Lareau, Alain Vadeboncoeur,** *Urgences-sante EMS, Montreal, Quebec, Canada*

Introduction. Prehospital electrocardiograms (phECGs) can accelerate identification of ST-Elevation MI (STEMI). However, their interpretation remains a challenge for providers of basic life support (BLS) systems who do not have this training. Computerized interpretation is widely available, yet the diagnostic accuracy of the latest software has not been well studied. **Objective.** To determine the diagnostic accuracy of computerized phECG interpretation for STEMI compared with cardiologists' interpretation as the gold standard. **Methods.** PhECGs performed by BLS providers in metropolitan Montreal, Canada over a 24-month period were collected. PhECGs were acquired with Zoll M Series[®] monitor-defibrillators using the GE-Marquette 12SL ECG Analysis ProgramTM

version 14. Indications for phECG acquisition included hemodynamically stable patients with chest pain of suspected cardiac origin, age ≥ 35 or with prior cardiac disease history. Two cardiologists, blinded to computerized diagnoses and patient information, retrospectively and independently reviewed each phECG for signs of "acute STEMI". Disagreement between cardiologists was resolved by a third cardiologist blinded to the other readings. The diagnostic test characteristics of the software code of "****Acute MI****" were calculated using the consensus cardiologists' interpretation as the gold standard. **Results.** Of the 1,535 available phECGs we excluded 169 (103 patient's age unknown, 66 poor quality), and analyzed 1366 (mean age 66 years; 54% male). Agreement between the first two cardiologists was high ($\kappa = 0.88$); 79 phECGs were reviewed by the third cardiologist. The computer identified 75 STEMIs, compared to 98 by the gold standard. Sensitivity of the computer was 61% (95% CI = 51–71%) while specificity was 99% (95% CI = 98–99%). The positive and negative likelihood ratios of the computer result were 52 (95% CI: 31–88) and 0.39 (95% CI: 0.31–0.50), respectively. Limitations. PhECG collection was non consecutive, and hemodynamically unstable patients were excluded, therefore the sample studied may not accurately represent the true prehospital chest pain population. **Conclusions.** We demonstrated high specificity and positive likelihood ratio of the computerized phECG interpretation. The low false positive rate suggests that decisions can be made based on the "****Acute MI****" code. Alternative strategies should be explored to compensate for the low sensitivity of this tool for STEMI.

24. NORMALIZATION OF DIAGNOSTIC FOR STEMI PREHOSPITAL ECG WITH NITROGLYCERIN THERAPY
Brian Daniel Mahoney, David A. Hildebrandt, Paul Allegra, Hennepin County Medical Center, Minneapolis, MN, United States of America

Hypothesis. The decision to take a patient for emergent reperfusion therapy is largely determined by an ECG diagnostic for ST Elevation Myocardial Infarction (STEMI). Hildebrandt et al have proven that prehospital 12 Lead ECGs followed by an immediate call for reperfusion team mobilization reduce door to balloon times. We hypothesize that prehospital ECGs will normalize in some STEMI patients after nitroglycerin (NTG) therapy or due to spontaneous reperfusion. NTG therapy before an ECG, or the absence of a prehospital ECG capacity in some services may lead to missing the early diagnosis of STEMI thus delaying reperfusion therapy. **Methods.** A prospective analysis of consecutive adult patients presenting to an urban/suburban two paramedic ambulance service from July 15, 2006, to August 15, 2007, who have diagnostic ECGs for STEMI.

Paramedics managing a possible myocardial infarction patient were instructed to obtain rapidly an ECG prior to treatment with NTG. If the initial ECG was diagnostic for STEMI the paramedic called to mobilize the reperfusion team. A second ECG was done prior to arrival at the ED. The ECGs were later reviewed by emergency physicians and cardiologists who confirmed the presence of a diagnostic prehospital ECG and STEMI. **Results.** During the 13 month interval, 87 patients had an initial ECG that was diagnostic for STEMI. These patients received no NTG from the paramedics prior to obtaining the first ECG. An average of 16 minutes 42 seconds later, 3 patients had an ECG that was no longer diagnostic for STEMI and 3 had a partial normalization in their ECG that made diagnosis of STEMI more difficult. **Conclusions.** Prehospital ECGs diagnostic for STEMI can normalize or become nondiagnostic after NTG administration or due to spontaneous reperfusion or evolution. In the absence of a prehospital ECG, it is possible that 6 of 87 (7%) of STEMI patients in this study would have had reperfusion delayed due to a rapid change in their ECG. Limitations include no control group receiving NTG prior to the first ECG.

25. COMPUTERIZED INTERPRETATION OF 12 LEAD DECREASES TIME TO REPERFUSION FOR EMS PATIENTS WITH ST ELEVATION MYOCARDIAL INFARCTION.
Joy Dunn, Rusty Rae, Duane Robinson, Patrick Medado, Carol Clark, Robert Swor, Wayne State University, Detroit, MI, United States of America

Introduction. Many EMS systems utilize computer EKG interpretation to triage STEMI patients to cardiac centers and mobilize emergency cardiac resources. Our objectives in this study were to: Assess the sensitivity of computerized EMS EKG interpretations and; Evaluate whether computer identification of STEMI increased the rate of early MI team activation and decreased time to reperfusion. **Methods.** We conducted a retrospective review of EMS STEMI patients transported to a single large suburban hospital. All patients with an ED diagnosis of STEMI and an EMS EKG performed using a specific device were considered for inclusion. Field ECGs, were dichotomized by computer interpretation of STEMI ("Acute MI Suspected" + or -). Paramedics used the computer EKG interpretation as one factor in diagnosing STEMI. EKGs were reviewed by one of study authors to identify if the field ECG was diagnostic for STEMI. We assessed whether + computer interpretation increased the rate of early hospital AMI team activation (activation prior to ED arrival), decreased the EMS patient contact to reperfusion interval, and increased the proportion with EMS contact-reperfusion <90 minutes. The study was approved as exempt by the hospital IRB. **Results.** We identified 92

STEMI patients with available EMS EKGs. Cases were excluded if EKG was non diagnostic upon physician review (10), or of poor technical quality (6); Of the remaining 76 STEMI's 49 (65.3%) were correctly interpreted by the computer as STEMI. Patients were not different between groups by gender age or time of day or week. Computer identification of STEMI was associated with an increased early MI team activation (71.7% vs 38.5%, $p < 0.006$) decreased EMS contact to reperfusion (71.9 min vs 91.6 min, $p = 0.03$) and increased proportion of EMS-reperfusion <90 minutes (51.6% vs 10.0%, Fisher's exact $p = 0.03$) **Conclusions.** 65% of ECGs were accurately interpreted by computer analysis. EMS systems that rely on computer EKG triage of STEMI patients may undertriage STEMI patients. Computer identification of STEMI was associated with an increased early MI team activation and decreased time to reperfusion. Further work is needed to clarify the diagnostic characteristics and value of field computerized 12-EKG interpretation.

26. POSITIVE PREDICTIVE VALUE OF PARAMEDIC AND EMERGENCY PHYSICIAN EKG INTERPRETATION FOR STEMI ARE IDENTICAL **Todd Gregory, Jonathan McGhee, Robert Rosenbaum, Robert E. O'Connor,** *Rutland Memorial Hospital, North Clarendon, VT, United States of America*

Purpose. We conducted this study to determine the effectiveness of prehospital EKG interpretation versus that of ED physicians in directing STEMI patients to the primary endpoint of PCI. Our hypothesis is that prehospital-obtained and -interpreted EKGs are adequate for the diagnosis of STEMI. **Methods.** A retrospective analysis was performed on all patients presenting with chest pain from May of 1999 to February of 2007 determined by prehospital and/or ED personnel to meet PCI criteria Paramedics were trained in the recognition and management of chest pain/ACS, technical aspects of EKG acquisition, were taught to recognize EKG criteria for STEMI, and to communicate their interpretation to the base station physician. Patients identified in the field as having criteria for STEMI are then "alerted" and transported to this institution, where the prehospital EKG in question can be interpreted by appropriate Emergency Department (ED) personnel. These patients are then either selected for PCI at the discretion of interventional cardiology. Statistical analysis was performed using regression analysis and Chi-square. **Results.** After multivariate analysis of the 3350 patients studied (mean age 62, 67% were male), 1,071 (32%) were "Alerted" to PCI in the prehospital setting, while 1,844 (55%) were determined to meet PCI criteria after presenting to the ED. Of the 1,071 Alerted patients, 788 received PCI (PPV 0.76), while 1,302 of the patients presenting directly to the ED received PCI (PPV 0.75).

Conclusions. At this institution, the PPV for prehospital EKG interpretation leading to subsequent PCI is not only adequate but equivalent to that of ED personnel. Therefore, in prehospital patients with STEMI, the standard of care should be prearrival activation of a PCI team whereby the ED could potentially be bypassed, thus shortening the time to PCI.

27. EFFECT OF A STEMI PROTOCOL ON AEROMEDICAL SCENE TIMES. **Daniel Geary, Michael Leicht, John Skiendzielewski,** *Geisinger Medical Center, Bloomsburg, PA, United States of America*

Introduction. Outcomes of interventional cath lab procedures for STEMI patients are improved by decreasing the time to the cath lab. Scene times for aeromedical transport STEMI patients were reviewed to determine the efficacy of protocols for shortening scene times for STEMI (ST elevation MI) transports. These STEMI protocols were implemented in the latter half of 2006 and included placing helicopter compatible stretchers at referring hospitals, keeping the helicopter hot during transfers, dividing the flight crew's responsibilities while on scene, and flight crew education to shorten scene times. Hypothesis. Aeromedical STEMI protocols will shorten scene times of patients with AMI. **Methods.** A chart review of aeromedical trip sheets and cardiac catheterization data was performed to determine scene times for STEMI patients who were transported to the catheterization lab. The cardiac catheterization lab provided a list of patients transferred to the catheterization lab by helicopter. The trip sheets were reviewed before the STEMI protocol was implemented from January 2006 through June 2006 and again after the STEMI protocol was implemented from January 2007 through June 2007. Patients who had a cardiac arrest while the aeromedical team was on scene were excluded from study. A total of 131 patients were transported during these times. Out of 131, 120 were transported by the hospital owned aeromedical service, and subsequently reviewed. The 120 transports represented 59 patients in 2006 and 61 patients in 2007. Three patients were excluded from study for documented arrest, 1 from 2006 and 2 from 2007. **Results.** In 2006, 58 patients were transferred from 13 hospitals and 1 EMS scene call, with an average scene time of 16:42, standard deviation of 6:06. In 2007, 59 patients were transferred from 12 hospitals and 5 EMS scene calls, with an average scene time of 14:33, standard deviation 5:15. This was statistically significant using t-test with a p-value <0.05. **Conclusion.** Implementation of transportation protocols including placing helicopter compatible stretchers at referring hospitals, keeping the helicopter hot during transfer, dividing the flight crew's responsibilities while on scene, and flight crew education is effective for reducing aeromedical scene times.

28. PREHOSPITAL STEMI DIAGNOSIS AND EARLY HELICOPTER DISPATCH TO EXPEDITE INTERFACILITY TRANSFER REDUCES TIME TO REPERFUSION Robert J. Hyde, Christine Kociszewski, Stephen H. Thomas, Suzanne K. Wedel, Paul J. Brennan, *Mayo Clinic, Rochester, MN, United States of America*

Purpose/Hypothesis. Multiple barriers exist that can delay the time to reperfusion in the ST-segment elevation myocardial infarction (STEMI) patient. The American College of Cardiology has promulgated a goal of less than 90 minutes from initial hospital contact to percutaneous coronary intervention (PCI). This "door-to-balloon" concept presumes dedicated resources to reperfusion are mobilized once the patient enters the hospital. In systems that utilize prehospital 12-lead electrocardiography (ECG) and are capable of prehospital STEMI diagnosis, further time reductions can be achieved via prehospital activation of resources that traditionally have been mobilized upon patient arrival in the hospital. Methods to reduce time to PCI are important in settings in which further streamlining of in-hospital time management (e.g., door-to-catheterization lab) is difficult or impossible. **Methods.** We developed a pathway whereby hospital-based paramedics activate helicopter EMS (HEMS) transport (in anticipation of interfacility transport to a facility capable of PCI) based upon prehospital 12-lead ECG identification of STEMI. The protocol enables HEMS activation before the patient arrives at the referring hospital's Emergency Department (ED). **Results.** Prior to pathway implementation, we retrospectively reviewed records from the previous year and identified 15 consecutive patients who would have met inclusion criteria into our pathway. These patients served as our control group. In the one-year study period, 22 patients met inclusion criteria for field activation of the STEMI pathway. Mean time from on-scene arrival to ECG diagnosis of STEMI was 10 minutes (range 1-20, IQR 4-18). Mean time from ECG diagnosis to ED arrival was 9.3 minutes. In the control group, mean time from ED arrival to HEMS activation was 21.8 minutes; whereas, mean time from prehospital ECG diagnosis to HEMS activation in the study group was 4.9 minutes ($p < 0.0001$). Mean time from ED arrival to HEMS departure to PCI facility in the control group versus the study group was 78.7 and 31.0 minutes, respectively ($p < 0.0001$). **Conclusions.** Using an early activation STEMI protocol that mobilizes community hospital ED resources, regional HEMS/critical care transport and tertiary care facilities with PCI capabilities, prehospital 12-lead ECG interpretation by hospital-based paramedics reduces overall time to PCI.

29. DOES EMS TRANSPORT DIRECTLY TO PERCUTANEOUS CORONARY INTERVENTION CENTERS IMPROVE

MYOCARDIAL INFARCTION SURVIVAL? Henry E. Wang, Oscar C. Marroquin, Kenneth J. Smith, *University of Pittsburgh, Pittsburgh, PA, United States of America*

Objective. National guidelines recommend that EMS transport ST-segment elevation myocardial infarction (STEMI) patients directly to primary percutaneous coronary intervention (PCI) centers. Few studies consider the influence of total STEMI treatment time variations (including additional EMS transport time) on the effectiveness of this strategy over fibrinolytic (FL) approaches. We evaluated whether EMS transport of STEMI to more distant primary PCI centers improves survival over nearest community hospital FL (CH-FL) or EMS out-of-hospital FL (EMS-FL), accounting for the influence of STEMI treatment time variations. **Methods.** We utilized a decision tree model comparing CH-FL or EMS-FL with PCI at a more distant center. We used data from 40 published studies to relate 30-day survival to total STEMI treatment time components (symptom onset through intervention). We excluded situations with STEMI misdiagnosis, FL contraindications or closer PCI centers. We considered four FL profiles: 1) standard and 2) best-case CH-FL, and 3) standard and 4) best-case EMS-FL. Using one-way and Monte Carlo sensitivity analyses, we evaluated how treatment time variations affected predicted STEMI survival and favored treatment strategy. **Results.** Baseline PCI survival over FL were: 1) standard CH-FL, RR = 1.02; 2) best-case CH-FL, RR = 1.00; 3) standard EMS-FL, RR = 1.01; 4) best-case EMS-FL, RR = 0.97. Favored strategy shifted from PCI to standard CH-FL when additional PCI center transport time >163 minutes or door-to-balloon >233 minutes. Favored strategy shifted to best-case CH-FL when chest pain-to-911 <60 or >220 minutes, additional PCI center transport >15 minutes, door-to-drug <10 minutes or door-to-balloon >220 minutes. Favored strategy shifted to standard EMS-FL when additional PCI center transport >157 minutes or door-to-balloon >223 minutes. Favored strategy shifted from best-case EMS-FL to PCI when response time >24 minutes or chest pain-to-911 = 104–220 minutes. Considering variations across all time components, Monte Carlo analysis slightly favored PCI over standard CH-FL (median RR 1.02, 95% range: 1.00–1.05) and standard EMS-FL (1.01; 1.00–1.03); there was no preferred strategy for best-case CH-FL (1.00; 0.96–1.02) or best-case EMS-FL (0.97; 0.96–1.01). **Conclusions.** Direct EMS transport of STEMI to PCI centers minimally improves survival over FL approaches. FL may supersede PCI in situations with prolonged STEMI symptom, EMS response, additional PCI center transport and door-to-balloon times.

30. LINKING THE ELDERLY TO COMMUNITY SOCIAL SUPPORT SERVICES UTILIZING AN EMS-BASED FOLLOW-UP PROGRAM Ricky C. Kue, Edward

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Introduction. 911 may be the only access to both medical and social services support for some elderly adults. **Objective.** To describe the experience of an EMS-based follow-up program providing elderly patients access to community-based services. **Methods.** Adults 60 and over were prospectively enrolled either immediately by paramedics at time of call or in a delayed fashion during routine medical director review of non-transport charts. EMS physician follow-up was then performed either by telephone interview or in-home visit depending on the reason for referral. Data was collected for age, sex, presence of established social services, enrollment strategy, complaint category, acceptance rate, and follow-up plan. Statistical significance was set at $p < 0.05$ for student's *t*-test and chi-squared analysis. **Results.** 70 participants were enrolled over a nine month period. Both groups were similar with respect to mean age and gender. Follow-up after a fall or lift assist constituted 45.7% (32/70) of all requests, occurring more often after delayed enrollment ($\chi^2 = 3.22, df = 1, p = 0.07$) compared with immediate enrollment. Paramedics immediately enrolled a significantly higher number of social service complaints (47.8% vs. 14.9%, $\chi^2 = 8.77, df = 1, p = 0.003$). The rate of previously established social services among participants was 55.7% (39/70). There was no difference in rates of established social services between elderly adults that accepted or declined follow-up (88.9% vs. 89.5%, $p = 0.95$), or between immediate versus delayed enrollment patients (92.6% vs. 89.7%, $p = 0.72$). Immediate paramedic enrollment was associated with a significantly higher rate of acceptance ($\chi^2 = 18.38, df = 1, p < 0.001$) compared to delayed enrollment. Cumulatively, 192 connections to 12 types of social services have been made. **Limitations.** Retrospective data analysis, limited sample size and selection bias with respect to time to enrollment. **Conclusions.** EMS can provide an invaluable opportunity to connect the elderly with community-based social services at time of contact. Offering immediate follow-up at time of EMS visit appears to be more effective in patient acceptance of social services. Paramedics appear to be able to capture significantly more social service related concerns at time of visit. Further studies are needed to address the impact of this program on EMS as well as social services utilization.

31. TRENDS AND FUNDING IN EMERGENCY MEDICINE SERVICES RESEARCH: 1996–2006

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Background. Although critical gaps in medicine research has been well studied, national and interna-

tional publishing and funding trends for prehospital medicine is lacking. **Objectives.** This study sought to identify the countries of origin of prehospital research, methodological characteristics, funding sources, scientific strength and ongoing trends in prehospital research among international and national journals. **Methods.** A computerized Medline search was performed and articles published from 1996 to 2005 that contained the word "emergency" in the primary author affiliation were selected. Articles were included if they contained the keywords "prehosp," "emergency medical services," "out of hospital," "paramedic," "medical dispatch," "dispatcher," or "EMS" in the abstract. Articles classified as news, commentary, letters, indexes, nursing, or veterinary sciences were excluded. We assigned journal impact factor from publishing journal to each article and analyzed the aggregate data for journal and country of origin, methodology, trends and acknowledgement of grant support. The accuracy of electronic capture was assessed by the authors. **Results.** Of the 14,605 total articles related to emergency medicine indexed in PubMed during the study period 977 (6.6%) were related to prehospital care. US authors published 778 (80%) followed by UK 81 (8.2%), Canada 33 (4.2%) and Australia 23 (2.9%). Among the US articles, NIH funding was acknowledged in 56 articles (7.1%). Canadian articles had a journal impact factor of 3.11 (+3.48) whereas U.S., U.K., and Australian articles had a journal impact factor of 1.60 (+1.99), 0.81 (+ 0.59) and 1.24 (+0.56), respectively. **Conclusions.** Although the U.S. is the largest publisher of prehospital research in the world, there should be an increased emphasis on improving study designs and obtaining funding for large scale clinical trials.

32. DO EMS PROVIDERS THINK THEY SHOULD PARTICIPATE IN DISEASE PREVENTION? **E. Brooke Lerner, Manish N. Shah, Antonio R. Fernandez, Medical College of Wisconsin, Milwaukee, WI, United States of America**

Objective. To determine EMS providers' opinions regarding participation in disease prevention as well as whether they should provide prevention services during emergency calls. A secondary objective was to determine the proportion of providers who had participated in disease prevention programs. **Methods.** As part of biennial re-registration paperwork, EMS providers re-registering in 2006 were asked to complete an optional survey regarding opinions on and participation in disease prevention. Demographic characteristics were also collected. Data were analyzed using descriptive statistics and 95% confidence intervals. Chi Square was used to compare differences by responder demographics. A 15% difference between groups was determined to be clinically significant and categories with less than 30 respondents were collapsed. **Results.** This preliminary analysis included

19,324 providers who completed the survey. When asked if EMS providers should participate in disease prevention 81.1% (95%CI: 80.5-81.6) said yes. When compared by demographics, providers who worked 20-29 hours per week were the least likely to think they should participate in prevention (62%, $p < 0.001$). 28.8% (95% CI: 28.2-29.5) of respondents reported actually having provided prevention services. Those who had a graduate degree were the most likely to have provided prevention services (40%, $p < 0.001$), as were those who had worked in EMS for more than 21 years (41%, $p < 0.001$) and those who worked for the military (52%, $p < 0.001$). When asked if prevention services should be provided during emergency calls 49.5% (95% CI: 48.8-50.2) of respondents said yes. This was similar in all demographic categories. 6.6% (95% CI: 6.2-6.9) of respondents had provided prevention services during emergency calls and no demographic differences existed. Those who had participated in prevention programs were more likely to respond that EMS providers should participate in prevention (92%, $p < 0.001$). Further, those who had provided prevention services during emergency calls were more likely to think EMS providers should provide prevention services during emergency calls (81%, $p < 0.001$). **Conclusions.** The majority of EMS providers thought that they should participate in prevention programs. The respondents were mixed as to whether prevention services should be provided while on emergency calls. However, those who had provided these services were strongly in favor of them.

33. PARAMEDICS' EXPERIENCE WITH PREHOSPITAL RESEARCH: A SURVEY Jan L. Jensen, Gredi A. Patrick, Andrew H. Travers, *Emergency Health Services, Dartmouth, Nova Scotia, Canada*

Background. Paramedics are increasingly becoming integrated within the health care continuum. This includes increasing participation in prehospital research by paramedics, however there is a paucity of information regarding their perception regarding their involvement in research. This study explores paramedic comprehension of and experiences in prehospital research participation. **Methods.** A cross-sectional online survey was sent to 318 paramedics with training and/or experience in research in a provincial ground ambulance system. Survey content evaluated the following domains: demographic, research education, and research experience (application of research protocols, consenting patients). Data was compiled from nominal and categorical datasets generated from Likert scales, and were analyzed and reported using descriptive statistics and logistic regression analysis. **Results.** A response rate of 49.3% (157/318) was achieved, with a mean 12 years of experience (SD 6.9); 75% male (117/318);

29% Primary Care Paramedics (PCP, 45/157), 24% Intermediate Care Paramedics (ICP, 38/157), and 47% Advanced/Critical Care Paramedics (ACP/CCP, 73/157). 95% of paramedics agree that research can improve patient care and 74% express interest to be involved with prehospital research projects. On a 5-point Likert scale (1 = low, 3 = average, 5 = high), paramedics report below average understanding of various aspects of research: mean 2.7 for research design, 2.8 for statistics, 3.1 for research articles, 2.0 for grant application procedures and 2.5 for ethics review. 15.1% of responses report having research education in their paramedic training and 23.0% report taken a college or university research or statistics course. A majority (79%) of respondents stated they were confident to apply a research protocol and 77.9% agreed to no or little extent they were nervous to approach a patient or family about a research project. Important limitations were selection bias towards medics identified having conducted research, reporting bias inherent in using an online survey and response rate less than half of participants. **Conclusions.** The results from this survey demonstrate that although both paramedics' understanding of research and research educational experience is low, paramedics are confident to conduct prehospital research. ACP/CCP trained paramedics appear to be more receptive to research compared to PCP/ICP. These findings will facilitate future integration of research into the paramedic scope of practice.

34. IDENTIFICATION AND MANAGEMENT OF INTIMATE PARTNER VIOLENCE IN EMS: A NEEDS ASSESSMENT Brian Schwartz, Robin Mason, Robert Burgess, Elaine Irwin, *Sunnybrook Osler Center for Prehospital Care, Toronto, Ontario, Canada*

Purpose. To investigate Emergency Medical Technician (EMT) knowledge and attitudes related to providing care to victims of Intimate Partner Violence (IPV). **Background.** IPV is a significant and hidden cause of morbidity and mortality. Research on health care for victims of IPV indicates that provider education is needed, yet few studies have examined EMT roles and competencies. **Methods.** Quantitative and qualitative data were collected. A validated questionnaire (Maiuro et al, 2000) was adapted to reflect EMT practice and posted on the jurisdictional (population 11 million, 6000 EMTs) paramedic association website. Data were analyzed using descriptive statistics. In addition, five focus groups of volunteers were conducted to collect more in-depth information: EMTs with >15 years experience; EMTs with <15 years experience; EMTs working in a rural setting; supervisors and dispatchers. Institutional Research Ethics Board approval was obtained. **Results.** Of 479 respondents, 35% were female, 56.5% were between ages 26 and 40, 35% worked in non-urban centers; 60%

had <10 years' and 24% >15 years' experience. In the past year, 44% recalled attending 1-5 IPV calls, 22% 6-10, 15% 11-20 and 9% > 20. Less than half (44%) correctly estimated the percentage of women victimized by IPV; while approximately the same number (43%) erroneously believed they were required to report IPV calls to police. Three quarters (74%) of respondents felt "somewhat prepared" to deal with an IPV call, 13% felt "ill prepared" and 13% "very prepared". The need for more formal training and education was expressed by 84% of respondents. All focus participants believed EMTs have a role in assisting victims of IPV and identified the need for more education to do so effectively. Most participants wished for resources to share with patients and identified dealing with their own emotional reactions as a particular challenge. Finally, many expressed frustration with the lack of continuity between prehospital and hospital care. **Conclusion.** EMTs have an opportunity to assist victims of IPV and would like to do so but require education to increase their sense of competency.

35. NEW MODEL OF FREESTANDING EMERGENCY FACILITY: FIRST YEAR OF SERVICE TO ITS COMMUNITY AND ALTERNATE EMS TRANSPORT DESTINATION FOR A LOCAL EMS SYSTEM Roger M. Stone, Benjamin J. Lawner, Michael A. McAdams, Joel Buzy, Richard L. Alcorta, Thomas W. Carr, Jr., *University of Maryland, Mount Airy, MD, United States of America*

Introduction. Hospital based emergency departments (HBEDs) nationwide are plagued by the challenges of overcrowding, which impact local emergency medical services (EMS) systems daily. Viable alternative transport destinations (ATD) for EMS to help relieve HBED overcrowding have not been widespread in the literature. Purpose of study: In 2006, Maryland enacted regulations enabling 24 hour full-service freestanding emergency facilities, staffed by trained emergency physicians. The Maryland Institute for Emergency Medical Services Systems (MIEMSS) responded with a unique local protocol enabling the designation of such as a receiving facility for low acuity EMS patients. The Germantown Emergency Center in Maryland (GEC) was the first to open under the protocol. We wished to evaluate data from its inaugural year of service to determine any effects on overall utilization of and EMS traffic to the closest HBED. **Methods.** Retrospective study using data from the GEC's parent health system's database and County EMS System dispatch database, in the inaugural year period and the year before the opening of the GEC. **Results.** From opening on August 7, 2006 through August 6, 2007, the GEC registered a census of 22,933, receiving 1,844 patients by ambulance (8%). The closest HBED realized a large reduction in census, from 87,601 the year before the GEC existed, to 76,578 dur-

ing the study period (13%). In the same period, the EMS system transported 14,347 to that HBED, compared to 16,266 the previous year (12% overall decrease). Where low acuity dispatches constitute 32% of the transports, this represents up to a 35 % decrease in low acuity transports when compared to a projected number if the GEC did not exist. This decrease occurred while transports for the County EMS system as a whole increased from 54,229 the previous year to 58,533 during the study (8%). **Conclusion.** A new 24-hour full-service freestanding emergency facility appeared to help decompress its local HBED, both as a walk-in resource and a viable ATD for low acuity EMS patients. More study is necessary to further determine the exact benefits and limitations of such a model.

36. RELATIONSHIP BETWEEN LENGTH OF STAY AT THE ED AND HOSPITAL MORTALITY Sang Do Shin, In Sool You, Jin Seong Cho, Ki Ok Ahn, Yu Jun Kim, Kyoung Jum Song, Ju Ok Park, *Seoul National University Hospital, Seoul, Republic of Korea*

Purpose. Crowding is an emerging problem in Korea. However, there has been no nation-wide report about the impact of crowding outcomes. We determined the effect of the Length of Stay at ED (LOS) on hospital mortality. **Methods.** Data were electronically obtained from the National Emergency Department Information System (NEDIS) including 60 EDs in 2006. The NEDIS contains information about crowding including patients number, LOS, clinical status, major interventions, and outcomes. To determine the effect of the LOS on mortality, we calculated odds ratios (ORs) using multivariate logistic regression analysis. The LOS was measured from departure to visiting time and was categorized to 9 ordered intervals (1%, 4%, 5%, 15%, 25%, 25%, 15%, 9%, and 1% from low to high) as distribution of log-transformation value. Death in the ED after treatment and death after admission was considered as primary and secondary outcomes. Adjustments were made for sex, age group, injury, utilization of EMS, type of insurance, visiting time, visiting weekday, resuscitation, intubation, ventilator care, and level of ED. **Results.** Total number of participants was 945,479 (male, 55.1%). Results from ED were as follows; discharge (64.9%), transfer to other hospital (2.8%), admission (26.0%), and death at ED (0.9%). Proportion of death after admission was 0.6% (N = 5,780). Mean LOS was distributed from 1.4 to 18.4 hours at 16 regional EDs and 0.6 to 25.0 hours at 44 local EDs. When second lowest interval was used as reference, the first lowest interval showed the highest OR for death in the ED (11.613, 95% confidence interval; 8.538-15.795). As the LOS increased, the ORs for death at ED also increased: 1.393 (1.059-1.847) at 3rd interval, 2.058 (1.612-2.629) at 4th interval, and 4.385 (3.249-5.918) at the longest interval, respectively.

These features were very similar on regression analysis for death after admission. First interval showed the highest ORs (13.111). The ORs of the other intervals also increased as the LOS increased (1.065 at 3rd interval, 1.224 at 4th interval, 3.123 at 9th interval), as compared to second LOS interval. **Conclusion.** LOS was very strongly related with death in the ED and death after admission in a nationwide overcrowding study in Korea.

37. PERSPECTIVES ON GERIATRICS EDUCATION FOR EMS PROVIDERS **Lars-Kristofer N. Peterson, Rollin J. Fairbanks, Manish N. Shah, University of Rochester, Rochester, NY, United States of America**

Background. Older adults (age ≥ 65) comprise approximately 40% of the EMS patient population, but EMS providers receive little geriatrics training. The geriatrics continuing education needs for EMS providers and the ideal delivery method to EMS providers have not been explored. **Objectives.** To identify the geriatrics continuing education needs of EMS providers and to identify the ideal characteristics of a geriatrics continuing education program. **Methods.** This qualitative study included interviews with a convenience sample of 20 EMS providers, two emergency physicians, six EMS instructors and administrators, and two geriatricians. Semi-structured interviews were conducted using a guide which addressed the following domains: 1) knowledge and skill deficiencies; 2) recommendations for improvement of geriatrics continuing education; 3) ideal delivery methods of education. The data were analyzed using standard qualitative methods. **Results.** Participant responses were congruous despite the diverse backgrounds. Redundancy was achieved rapidly. All felt continuing education on geriatrics topics is needed. Most EMS providers felt comfortable with their skills in caring for older adults. Comments were categorized into three themes: 1) education related to medical and psychosocial issues such as polypharmacy, depression, social services, and public health; 2) education regarding efficient communication with nursing home staff and empathetic communications with patients; and 3) the desired methods of content delivery. Preferred education delivery methods varied, with some preferring self study modules and others preferring classes which rely less on self-motivation. **Conclusion.** Geriatrics continuing education for EMS providers is needed. Some specific topics relate to medical issues, but a large proportion involve psychosocial, public health, and communications issues. Education should be delivered through a variety of modalities to meet the needs of the EMS community.

38. THE FEASIBILITY AND EFFECTIVENESS OF USING DAILY MANIKIN PRACTICE TO IMPROVE INTUBATION

SUCCESS **Jeffrey Lubin, Robert Carter, University Hospitals Case Medical Center, Cleveland, OH, United States of America**

Purpose. Airway management is an essential skill for prehospital and critical care transport providers. Opportunities to practice intubation are limited, so other means to improve this skill must be researched. Some authorities in the psychology of learning have developed a concept of "deliberate practice," claiming that exceptional performance simply reflects extended periods of intense training and preparation. This study evaluates if intubation practice using standard airway manikins during each shift over six months increases the success rate of providers when they perform intubations on actual patients. **Methods.** Study participants were members of a ground Critical Care Transport Team, including Registered Nurses and Paramedics. Investigators performed a six month review of previous trips, compiling the number of attempts at intubation and success rates. During the six month intervention period, participants were asked to perform repeated daily intubations on standard airway manikins. The setting and technique used were changed weekly and were determined by the study investigators. Intubation success rates, on the manikins and on actual patients, were recorded during this period, along with compliance with study protocols. **Results.** Data were analyzed using a generalized estimation equations logistic regression to compare between stages of the study and a least squares linear regression to examine the rate of successful intubation of the manikins and compliance with the study during the intervention period. The p-value for the GEE logistic model comparing success rates between the pre-intervention and the intervention periods was 0.63 with a z-statistic of 0.48. The odds ratio was 1.37 (95% CI: 0.38, 4.92). There was no significant trend in the rate of successful intubation of the manikins with a linear regression slope of 0.00016 (95% CI: -0.0039, 0.0042). However, compliance with the study declined significantly over the six months, as indicated by a linear regression slope of -0.0239 (95% CI: -0.0354, -0.0124). **Conclusions.** Daily practice with standard airway manikins by a critical care transport team did not improve intubation success on actual patients. Compliance with the study declined significantly over six months. It may not be feasible or effective to use this technique to improve intubation performance.

39. EDUCATION IS BENEFICIAL TO IMPROVE ADHERENCE TO INTUBATION VERIFICATION TECHNIQUES AND DOCUMENTATION **Kevin Tishkowski, Raymond Little, Steve Myers, Kathryn Cockerham, Mobile Medical Response, Inc., Saginaw, MI, United States of America**

Introduction. Many national organizations endorse set principles regarding the confirmation of tracheal tube

placement in the out-of-hospital setting. Even with such policies in place, paramedic education on the importance of correct verification remains low and the documentation on correct ET tube placement is inadequate. **Objective.** To evaluate current documentation of correct ET tube placement and to evaluate the efficacy of education on the verification and documentation of correct tracheal tube placement in the out-of-hospital setting. **Methods.** Retrospective chart reviews were conducted in 9 counties (urban/suburban/rural settings) on all intubated pre-hospital patients before and after education on intubation verification techniques and on the importance of documentation. Charts were reviewed for documentation of six criteria: direct visualization of the ET tube passing through the vocal cords, use of end-tidal CO₂ detection, presence of equal breath sounds, absence of gastric sounds, condensation in the ET tube and the use of a commercial tube holder. Between these two studies, paramedics were instructed on the importance of intubation verification techniques and documentation. **Results.** 52 patients with placed endotracheal tubes were identified on the pre-education study, and 53 patients were identified on the post-education study. Documentation of each six indicators increased: direct visualization of the ET tube passing through the vocal cords increased from 37% to 95%, end-tidal CO₂ detection increased from 22% to 84%, equal breath sounds increased from 93% to 97%, absence of gastric sounds increased from 30% to 83%, condensation in the ET tube increased from 22% to 88%, use of a commercial tube holder increased from 37% to 87%. Documentation of all six criteria together increased from 1% to 73%. In accordance with ACEP's policy on confirmation of ET tube placement either by direct visualization or by use of ET/CO₂, documentation of at least one of these indicators increased from 44% to 96%. **Conclusion.** Paramedic confirmation and/or documentation of verification of correct ET tube placement is inadequate. System-wide education is beneficial in order to improve adherence to intubation verification techniques and documentation of these techniques.

40. THE DEVELOPMENT OF A NATIONAL EMERGENCY MEDICAL SERVICES CURRICULUM FOR PHYSICIANS IN CANADA. **Russell D. MacDonald, Joseph Ip, Karen Wanger, Adrienne Rothney, Kirstie McLelland, Andrew H. Travers, P. Richard Verbeek, Sunil Sookram, Erik Vu, Ed Cain, Ornge Transport Medicine / University of Toronto, Toronto, Ontario, Canada**

Introduction. As the role of EMS continues to expand, EMS physicians and medical directors require special skills and training to keep pace with the rapidly evolving subspecialty of EMS. In Canada, subspecialty training in EMS is still relatively new and a standard national curriculum for physician EMS training does not

exist. **Objective.** To develop a national EMS curriculum for EM residents and fellows, and an abbreviated curriculum for non-EM trainees and community physicians. **Methods.** Authors obtained EMS curriculum and opportunities from Canadian emergency medicine and EMS training programs and a sample of US programs to determine existing curricula, and developed a framework for a national EMS curriculum using an expert working group of EMS medical directors and EMS leaders in Canada. **Results.** Canadian emergency medicine residency training programs included an EMS rotation, but their content and depth of training was not uniform. The expert working group proposed a comprehensive set of training objectives, grouped into 16 categories, stratified by level of training. **Conclusion.** The proposed framework and objectives are suitable for training medical students, Family Medicine trainees, community physicians, emergency medicine residents, and fellows in Canada. The authors hope this manuscript will serve as a guideline for residency and fellowship directors to develop their EMS training programs in a consistent manner, promote formal training for physicians involved in EMS, and help define the specific knowledge and expertise required of physicians who provide EMS medical direction in EMS in Canada.

41. QUALITY OF BASIC LIFE SUPPORT SKILLS AMONG EMS-CERTIFIED PHYSICIANS IN AUSTRIA **Peter Nagele, Michael Huepfl, Medical University of Vienna/Washington University in St. Louis, St. Louis, MO, United States of America**

Introduction. The 2005 CPR guidelines have reiterated the importance of basic life support (BLS) skills for survival after cardiac arrest. Outside the U.S., many countries have implemented a tiered system with physician-staffed ALS units. Many licensed physicians in Austria obtain additional certification for prehospital emergency care by attending a 2-weeklong course although only a small fraction actually work as EMS (emergency medical services) physicians. The goal of our study was to test the quality of the BLS skills of physicians with EMS certificate in Austria. **Methods.** During mandatory biannual recertification seminars, we invited all attending EMS-certified physicians to participate in this study. The simulated standard scenario was single-rescuer BLS for an adult cardiac arrest victim without the use of an automated external defibrillator (AED) and bag-mask-valve ventilation. BLS quality was assessed using the Resusci[®] Anne manikin. We recorded the quality of the initial check, the correct call for help/assistance, mouth-to-mouth ventilations and chest compressions. **Results.** We included 167 physicians into our study, of whom only a small fraction actually works in the prehospital setting. The overall quality of BLS was poor: initial check and mouth-to-mouth

ventilations were performed correctly by 49 of 167 (29%) and chest compressions by 35 of 167 physicians (21%). Overall, only 14 physicians (8%) made no mistake during BLS; 86 physicians (51%) made at least one major mistake and would have failed a formal BLS skills test. The remaining 98 physicians (59%) made some minor errors that -judged by BLS instructors- could have been easily corrected (e.g.m rate of chest compressions per min too high or low). **Conclusions.** Our study shows a sobering picture of the quality of BLS among EMS certified physicians in Austria. Only 1 out of 12 physicians performed BLS at the published standard and half of all attending physicians would have failed a formal BLS test. Based on our results and the recognized importance of BLS for survival after cardiac arrest, physicians should practice BLS more regularly and frequently, in particular if they consider working in the prehospital setting.

42. SMOKING AND CESSATION PATTERNS AMONG NATIONALLY REGISTERED EMERGENCY MEDICAL SERVICES PROFESSIONALS **Antonio R. Fernandez, Jonathan R. Studnek, National Registry of EMTs, Columbus, OH, United States of America**

Objective. Health hazards related to smoking tobacco are well documented. However, there remains a paucity of research describing smoking patterns among EMS professionals. The objective of this study was to describe the prevalence of smoking in this population. It was hypothesized that recent quit attempts were related to demographic characteristics. **Methods.** As part of biennial re-registration paperwork, nationally registered EMS professionals re-registering in 2007 were asked to complete a survey. Individuals reported if they had smoked at least 100 cigarettes in their life, their current smoking status, and if they had attempted to quit within the last 12 months. Four variables related to smoking patterns were created (ever smokers, current smokers, ever quitters, and recent quitters). Descriptive analyses were conducted and chi-square analyses were utilized to test the stated hypothesis. **Results.** In 2007, 58,435 individuals re-registered with 30,560 (52%) returning surveys. A complete case analysis was performed leaving 20,541 (35%) cases. There were 7,299 (35.5%) individuals reporting ever smoking tobacco. Of those 3,713 (50.9%) report no longer smoking. Of the remaining 3,586 current smokers, 3,513 (98.0%) individuals attempted to quit within the last 12 months. Only 1,179 (33.6%) reported currently not smoking. Those working for fire based services reported the highest percentage of currently not smoking after a recent quit attempt, while those working for county/municipal services had the lowest (fire based 40.0%, other 38.8%, hospital based 33.7%, private 31.2%, military 31.1%, and county/municipal 29.0%, $X^2 = 25.9$, $p < 0.001$).

A higher percentage of females reported being current smokers (female 25.5% vs. male 19.7% $p < 0.001$). Males reported a higher percentage currently not smoking after a recent quit attempt (male 35.7% vs. female 29.0%, $p < 0.001$). **Conclusion.** The Behavioral Risk Factor Surveillance System indicates that 18.4% of females in the general population are current smokers. The percentage of current female smokers in this study was notably higher. However, nearly every smoker in this population recently attempted to quit. There were sub-populations, among those who recently attempted to quit, that report a lower percentage of currently not smoking, specifically females and those working for county/municipal services. Future investigations should examine why these disparities exist.

43. BODY MASS INDEX OF EMERGENCY MEDICAL SERVICES PROFESSIONALS **Antonio R. Fernandez, Jonathan R. Studnek, Lynn White, National Registry of EMTs, Columbus, OH, United States of America**

Objective. The Center for Disease Control and Prevention states that individuals with a Body Mass Index (BMI) ≥ 25 kg/m² are at increased risk for many diseases and health conditions. The objective of this study was to quantify the BMI of EMS professionals. It was hypothesized that demographic characteristics would be associated with BMI. **Methods.** As part of biennial re-registration paperwork, nationally registered EMS professionals re-registering in 2007 were asked to complete a survey. BMI was calculated using participant's self reported height and weight. Individuals were placed into two categories of BMI, normal (<25) and high (≥ 25). Demographic variables such as community size (rural or urban), certification level (EMT-Basic, EMT-Intermediate or Paramedic), and service type (fire based, county/municipal, private, military, hospital based, or other) were also collected. Statistical analysis was conducted using chi-square analysis. **Results.** In 2007, 58,435 individuals re-registered with 30,560 (52%) returning surveys. A complete case analysis was performed using 21,149 (36%) cases. The mean BMI for study participants was 27.74 (95% CI: 27.68–27.81). There were 15,127 (71.5%) individuals classified as having high BMI. More males reported having a high BMI compared to females (79.2% vs 50.8% $p < 0.001$). A step wise increase in the percentage of those reporting high BMI was present when comparing provider's certification level (EMT-Basic 68.0%, EMT-Intermediate 73.4%, and Paramedic 77.0% $X^2 = 185.2$, $p < 0.001$). Those working for a military service reported the lowest prevalence of high BMI, while those who worked for a fire based service had the highest (military 61.7%, hospital based 67.9%, other 69.5%, private 71.8%, county/municipal 73.8%, and fire based 77.7% $X^2 = 356.9$, $p < 0.001$). There was no difference

between EMS providers working in rural or urban areas. **Conclusion.** Recent estimates from the Behavioral Risk Factor Surveillance System indicate that 61.6% of the general population is classified as having high BMI. Nearly three quarters of the study population were categorized as having a BMI ≥ 25 . High BMI was significantly associated with gender, certification level, and service type. Strategies for preventing obesity and decreasing body weight should be developed and implemented for professionals who provide health care and serve as role models.

43. DO EMERGENCY MEDICAL SERVICES PROFESSIONALS MEET CDC PHYSICAL ACTIVITY RECOMMENDATIONS? **Jonathan R. Studnek, Antonio R. Fernandez,** *National Registry of EMTs, Columbus, OH, United States of America*

Objective. The Centers for Disease Control and Prevention (CDC) recommends individual participation in moderate-intensity physical activity for 30 minutes or more, 5 or more days per week. This study quantifies the number of EMS professionals achieving CDC physical activity recommendations. It was hypothesized that work related demographic characteristics would be associated with meeting CDC recommendations. **Methods.** As part of the National Registry of EMTs biennial paperwork, EMS professionals, re-registering in 2007, were asked to complete a survey. Individuals who reported that they participated in moderate-intensity physical activity during the last 30 days, for 5 or more days a week, for at least 30 minutes, were categorized as meeting CDC recommendations. Demographic variables such as community size (rural or urban), certification level (EMT-Basic, EMT-Intermediate or Paramedic), and service type (fire based, county/municipal, private, military, hospital based, or other) were also collected. Statistical analysis was conducted using Chi-square analysis. **Results.** In 2007, 58,435 individuals re-registered with 30,560 (52%) returning surveys. A complete case analysis was performed using 21,149 (36%) cases. There were 5,184 (24.3%) participants who met CDC recommendations. Males were more likely to report meeting CDC recommendations (25.4% vs. 21.4% $p < 0.001$). A stepwise decrease in the percentage of those meeting CDC recommendations was present when comparing provider's certification level (EMT-Basic 28.5%, EMT-Intermediate 21.5%, and Paramedic 18.0% $X^2 = 283.5$, $p < 0.001$). Those working for a military service reported the highest prevalence of meeting CDC recommendations, while those who worked for a hospital based service had the lowest (military 41.2%, other 25.1%, fire based 23.5%, county/municipal 18.0%, private 16.5%, and hospital based 15.7% $X^2 = 915.7$, $p < 0.001$). While statistically significant there does not appear to be a

practical difference between EMS professionals working in rural or urban areas (rural 23.6% vs. urban 24.9%, $p = 0.03$). **Conclusion.** Less than a quarter of nationally registered EMS professionals, in this study, met CDC recommendations for physical activity. Furthermore, there did not appear to be a subpopulation of EMS professionals in which a majority of individuals met recommendation guidelines. Further research should focus on ways to encourage increased physical activity levels for EMS professionals.

45. ANALYSIS OF PUBLIC SAFETY LINE-OF-DUTY INJURIES **Joe Suyama, Jon Rittenberger, David Hostler,** *University of Pittsburgh, Pittsburgh, PA, United States of America*

Introduction. Continuous operation of emergency medical services (EMS), fire, and police personnel is required to protect and maintain the welfare of the community. During normal operations, public safety personnel may become injured leading them to seek medical care and potentially resulting in missed work. An examination of the nature and patterns of injury may identify preventative measures or application of appropriate safety procedures to reduce injury and maintain operational readiness. **Objective.** To determine the types and severity of on-duty injuries suffered by public safety personnel from one urban community. **Methods.** We examined de-identified worker compensation (WC) data for EMS, fire, and police providers from one urban center from January 1, 2005– to May 31, 2007. Data included type of injury, severity of injury, and date of event date. Severity was categorized as serious (lost work time), moderate (medical assessment), and minor (report only). **Results.** During this period, an average work force of 850 firefighters, 194 EMS providers, and 850 police officers were employed. A total of 1295 WC events were documented with 210 reported from EMS (16%), 477 from fire (37%), and 608 from police (47%). When normalized to personnel and years of exposure, the rate of injury was highest in EMS (1 injury per 0.45 person-years) when compared to fire (1 per 0.23) and police (1 per 0.30). 334 (29.6%) resulted in lost work time (serious). Serious injuries were more common in fire (41%) and police (40%) than EMS (19%). WC events common to all bureaus were minor trauma (76%) and blood borne pathogens exposures (12%). Minor traumatic events, mostly associated with axial musculoskeletal strains and extremity injuries, were responsible for the majority of serious injuries resulting in missed work. Injuries common to a specific bureau included motor vehicle crashes and gun shot wounds (police) and cardiovascular disease, burns, and heat illness (fire). **Conclusion.** Public safety personnel are affected by profession specific and non-specific injuries. While fire and police suffer higher rates of serious

injuries, EMS personnel suffer the highest rate of injury per person-year of exposure.

46. FACTORS INFLUENCING EMS PROVIDERS' INTENT TO STAY IN THE WORKFORCE **Michael G. Millin, Roger E. Levine, Johns Hopkins University School of Medicine, National Registry of EMTs, Baltimore, MD, United States of America**

Background. It is important to understand factors that contribute to intent to stay to insure a motivated workforce. We hypothesized that intent to stay will be related to: level - with paramedics intending to stay more than EMT-basics; type of employer - with fire service providers intending to stay more than private or government employees; and location - with urban providers intending to stay more than rural (defined as population under 25,000) providers. We also hypothesized that intent to stay would be lower where the need for EMS staff is greater. **Methods.** Data were collected through the Longitudinal Emergency Medical Technician Attributes and Demographics Study (LEADS), an annual survey of 5,500 nationally registered EMS providers. Intent to stay was assessed by asking the likelihood of leaving the EMS profession in the next 12 months, with higher values indicating a greater likelihood of staying. Multivariate models were developed to assess the independent impacts of level, employer, and location. Those saying they would probably or definitely leave were classified as 'Leavers'; those saying probably or definitely stay were classified as 'Stayers.' EMS providers' responses to "Are there enough EMS providers being trained in your area to maintain adequate staffing levels?" were recoded, with higher values indicating greater agreement. **Results.** Multivariate analyses indicated no significant differences in intent to stay between providers as a function of level or location. However, while the intent to stay of providers in the fire-service (89.6) was not greater than providers in government agencies (86.4), it was significantly greater than providers working for private agencies (82.1, $p = 0.0002$). "Leavers" and "Stayers" had significantly different perceptions of EMS shortages. Leavers perceived greater staffing shortages in their area than Stayers (42.9 vs. 54.5, $p = 0.017$). However, only Paramedic Leavers (53.3 vs. 38.1, $p = 0.028$) and Leavers in rural areas (34.7 vs. 49.3, $p = 0.034$) differed significantly from comparable Stayers in their perceptions. **Conclusion.** This analysis demonstrates that providers in the fire-service have the highest intent to stay. Those leaving the workforce at the paramedic level and working in rural areas perceived greater workforce shortages than their counterparts.

47. DESCRIBING THE AMOUNT OF MEDICAL DIRECTOR CONTACT AMONG NATIONALLY REGISTERED EMER-

GENCY MEDICAL SERVICES PROFESSIONALS **Jonathan R. Studnek, Antonio R. Fernandez, Gregg S. Margolis, Robert E. O'Connor, National Registry of EMTs, Columbus, OH, United States of America**

Objective. The objective of this study was to determine the amount of medical director (MD) contact that nationally registered EMS professionals receive. The secondary objective was to determine whether differences in MD contact were associated with work related characteristics. **Methods.** As part of biennial re-registration paperwork, nationally registered EMS professionals re-registering in 2004 were asked to complete a survey regarding medical direction. There were three survey questions asking participants to indicate, on a five point scale, how often they interacted with their medical director in specific situations (participation in continuing education, met personally to discuss an EMS issue, and saw MD at the scene of an EMS call). Individuals were categorized as having limited MD contact if they had not observed their medical director in any of the above situations for more than six months. All others were categorized as having recent MD contact. Demographic characteristics were collected and statistical analysis was performed using chi-square. **Results.** In 2004, 45,173 individuals re-registered with 28,647 (63%) returning surveys. A complete case analysis was performed leaving 22,026 (49%) cases. There were 13,756 (62.5%) individuals who reported having recent MD contact. A step wise increase in the percentage of those reporting recent MD contact was present when comparing provider's certification level (EMT-Basic 47.6%, EMT-Intermediate 62.3%, and Paramedic 78.5%, $p < 0.001$). The highest percentage of recent MD contact was reported by those who worked for a hospital based service, while the lowest percentage was reported by volunteer services (hospital based 78.8%, county/municipal 70.8%, private 67.6%, military 62.4%, government 61.1%, fire based 57.0%, and volunteer 50.8% $X^2 = 712.4$, $p < 0.001$). EMS professionals working in urban areas were more likely to report recent MD contact than those in rural areas (64.9% vs. 59.2% $p < 0.001$). **Conclusion.** EMS systems require knowledgeable physician participation and supervision at every level. However, nearly one-third of participants in this study reported having limited MD contact. Certification level, service type and community size were significantly associated with the amount of contact with medical direction.

48. THE INCIDENCE OF CARBON MONOXIDE POISONING DURING CO ALARM INVESTIGATIONS **David Hostler, Ronald N. Roth, Richard E. Kaufman, Kenneth D. Katz, Daniel E. Brooks, Anthony F. Pizon, Kevin O'Toole, University of Pittsburgh, Pittsburgh, PA, United States of America**

Background. Calls for carbon monoxide (CO) alarm activation are common among fire and EMS agencies. However, while monitoring a structure for CO levels is common, the relationship between ambient CO and carboxyhemoglobin (COHb) levels in exposed individuals is unknown. **Objectives.** A novel strategy was implemented using a non-invasive (SpCO) device to determine whether a correlation existed between ambient CO levels and COHb in the exposed occupants. **Methods.** As part of a QI initiative, non-invasive SpCO monitors (RAD-57, Masimo) were placed with three heavy rescue companies which were routinely dispatched to CO alarms. Responders obtained COHb levels on all occupants in a structure where environmental CO was measured with a standard four-gas meter. Age, gender, vital signs, and treatment disposition were documented in all patients. The relationship between ambient CO and COHb levels was identified with a Pearson's Correlation Coefficient. **Results.** 94 patients from 48 separate incidents had COHb and ambient CO levels recorded. 75.5% of calls were for audible CO alarms while the remaining were dispatched by the first arriving EMS crews as suspicious for CO poisoning. 63 (67%) of subjects were female and 64 (68%) were smokers. Nine (11%) subjects were transported to the emergency department (ED). All of these patients transferred to the ED were symptomatic with mean on-scene COHb level of 27.8% (19.5, 36.1). ED serum COHb levels obtained in these nine patients were 22.1% (17.0, 27.2). Mean COHb for those not transported to the ED was 3.2% (2.6, 3.8) and no individual had a level higher than 10%. Ambient CO levels ranged from 0-1500 ppm with a mean of 84.0 (95% CI: 34.6-133.5). Ambient CO and COHb measured non-invasively on the scene were correlated highly ($r^2 = 0.66$, $p < 0.001$). **Conclusions.** Non-invasive COHb accurately identified subjects with elevated serum CO. In this cohort, ambient CO levels below 200 ppm were never associated with COHb levels above 10% although the duration of exposure could not be accurately determined. CO oximetry may be a useful adjunct when assessing occupants from a CO contaminated structure.

49. METHICILLIN-RESISTANT STAPHYLOCOCCUS AUREUS PREVALENCE ON STETHOSCOPIES OF EMS PROFESSIONALS **Mark A. Merlin, Matthew Wong, Peter Pryor, Kevin Rynn, Michael Newlon, Rachael Perri, Timothy Fallon, Robert Wood Johnson Medical School, Livingston, NJ, United States of America**

We sought to determine the prevalence of methicillin-resistant *Staphylococcus aureus* (MRSA) on stethoscopes of Emergency Medical Service (EMS) providers, and to identify if last stethoscope cleaning is a risk factor associated with MRSA colonization. MRSA prevalence in the pre-hospital setting has limited documen-

tation in the literature, and stethoscopes are known fomites for MRSA. We conducted a prospective observational cohort study of 50 stethoscopes involving consecutive consenting EMS providers at an academic Emergency Department. Reported length of time since last stethoscope cleaning was recorded as a potential risk factor. Stethoscopes were swabbed and samples were cultured on a commercial MRSA test kit of mannitol salt agar with oxacillin. After 72 hours of incubation at 37 Celsius, two Emergency Physicians and one Microbiologist analyzed the plates independently. MRSA colonization was recorded as positive if all three reviewers agreed that colonization occurred. Univariate logistic regression with robust standard errors was performed to determine the association of reported length of time since last cleaning and MRSA colonization. Of 50 Stethoscopes, 16 (32.00%) had MRSA colonization, and 16 of 50 EMS providers (32.00%) had no recollection of when their stethoscopes were cleaned last. Reported length since last cleaning ranges were grouped into six categories: 1-7 days, 8-14 days, 15-30 days, 31-180 days, 181-365 days, and unknown. The median reported length of time since last cleaning was 1-7 days. In the univariate model predicting MRSA colonization, samples without a reported length of time since last cleaning were excluded. In the model, an increase in one time category to the next increased the odds of MRSA colonization by 0.860 (OR = 1.860, $p = 0.038$) In this ED setting, MRSA was found on approximately 1 in 3 stethoscopes of EMS professionals. A longer length of time since last stethoscope cleaning increased the odds of MRSA colonization.

50. ARRIVAL WITH EMS DOES NOT PREDICT ADMISSION IN PATIENTS WITH SYNCOPE **Howard Felderman, Brian Walsh, Morristown Memorial Hospital, Morristown, NJ, United States of America**

Objective. Estimating the severity of illness is a crucial part of the initial triage in an Emergency Department. Arrival with Emergency Medical Services (EMS) is considered to be an increased risk factor in this initial triage, although it is unproven to date. We sought to determine the significance of mode of arrival in patients diagnosed with syncope. **Methods.** A retrospective analysis of all patients seen in four Emergency Departments between November 1, 2004, and October 31, 2006, was conducted. All patients with a primary diagnosis of syncope were included. These patients were subdivided into 20-year age groups (0-20, 21-40, 41-60, 61-80, >80). We used admission to the hospital as a marker for severity of illness. We calculated the odds ratio (OR) and 95% confidence intervals for admission to the hospital for those who arrived with EMS versus those who arrived without EMS. **Results.** Of the 231,218 patients in our database, 2,617 (1.1%) of them had a

primary diagnosis of syncope. Of these, 1,202 (46%) were admitted and 1,761 (67%) arrived with EMS. The percent of patients arriving with EMS and the percent of patients admitted to the hospital increased with increasing age. In all of the age groups, however, the ORs for admission were not significant. In 0–20 age group, OR = 2.7 [0.8–9.5]; in the 21–40 age group, OR = 1.0 [0.6–1.7]; in the 41–60 age group, OR = 1.2 [0.8–1.7]; in the 61–80 age group, OR = 1.3 [0.9–1.8]; and in the >80 age group, OR = 0.9 [0.5–1.5]. **Conclusion.** While older patient are more likely to arrive with EMS and more likely to be admitted to the hospital, arrival with EMS is not associated with an increased rate of admission when controlled for age. Thus, in patients with syncope, arrival with EMS alone should not be used to triage patients to a higher acuity.

51. EPIDEMIOLOGY OF BEHAVIORAL HEALTH RELATED EMS TRANSPORTS Paul Daniel Patterson, Gary S. Cuddeback, Jane H. Brice, Charity G. Moore, *University of Pittsburgh, Pittsburgh, PA, United States of America*

Objective. While potentially millions of Americans are transported by EMS for some sort of behavioral health (BH) issue, little is known about these individuals. We explore prehospital impressions as well as characteristics of individuals diagnosed with mental illness in the Emergency Department (ED). **Methods.** We analyzed EMS transport, hospital ED, and inpatient data from three counties in a Southeastern US state from January 2001 to March 2003. BH transport was defined by having a primary or secondary mental illness ED diagnosis (ICD9 290–305, 307–319). Stratifying all transports by BH, we investigated the distribution of patient characteristics. We also investigated the most prevalent dispatch and EMT-provider impressions. We used t-tests and chi-square tests to compare continuous and categorical variables. **Results.** A total of 70,126 EMS to ED transports were analyzed. Eight percent of transports involved persons with a BH issue (n = 5,612). Individuals transported for BH issues were more likely male (60%), younger (M = 41 yrs), uninsured (36.7%), from an urban area (86.2%), and less likely to be admitted to the hospital (20%) versus transports for individuals diagnosed with other conditions (all p values < 0.05). Among admissions, the average length of stay was significantly longer for BH transports versus other transports (8.5d vs. 6.8d; p < 0.0001). Non-Dependent Abuse of Drugs (23.7%, n = 1,330, ICD9 = 305), Depressive Disorder (7.5%, n = 421, ICD9 = 311), and Unspecified Non-Psychotic Disorder (5.8%, n = 325, ICD9 = 300.9) were the most common BH conditions. Among all EMS dispatches coded as behavioral (n = 6,613), only 75.6% (n = 5,000) and 45.9% (n = 3,036) were coded as behavioral by EMTs and as mental illness by receiving ED physicians, respectively. **Conclusions.** A substantial proportion

of EMS transports involve persons presenting with mental illness and behavioral health issues; however, significant proportions are not admitted to the hospital for behavioral or primary care. Just as the criminal justice system has developed special strategies for managing persons with mental illness (i.e., Crisis Intervention Teams, and close collaboration with mobile mental health teams), EMS needs its own strategies for screening, assessing and managing non-medical, behavioral health calls to provide optimal care in the prehospital environment.

52. THE EVOLUTION OF ANALGESIA IN EMS: A COMPARISON OF MORPHINE ANALGESIA PRE AND POST STANDING ORDERS Erik A. Rueckmann, Courtney Jones, Manish N. Shah, Vijay Bansal, *University of Rochester, Rochester, NY, United States of America*

Background. Historically, New York State has required on-line medical control for the administration of morphine analgesia. Paramedic providers felt that this was a barrier to morphine administration, leading to inadequate treatment of patients who were in pain. Therefore, the prehospital pain management protocol was recently changed to standing orders for patients meeting protocol parameters within Monroe County, New York. **Objective.** Initiate a preliminary assessment of how the implementation of standing orders has changed the administration of morphine analgesia in Monroe County, NY through a combination of quantitative and qualitative analyses. **Methods.** A survey was developed and distributed to 9 EMS agencies to compare narcotic administration during the 2 months after the introduction of standing orders for morphine (June–July 2007) and the same time period one year prior (June–July 2006). Agencies provided information on morphine administration, call volume, and numbers of paramedic providers during those time periods. Qualitative semistructured interviews were conducted with 25 paramedics to assess opinions of how the introduction of standing orders has changed their practice treating pain. **Results.** The quantitative survey had a 55% response rate which encompassed >75% of call volume in Monroe County, NY. The total number of morphine administrations increased from 103 times (2006) to 127 times (2007), while total milligrams of morphine increased from 514.5 mg (2006) to 760.5 mg (2007) with similar call volume. However, this difference was not statistically significant. Qualitative themes included changes in paramedic practice, decreased “hassle” in administering morphine, and improved patient care without adverse patient events. **Conclusion.** Quantitatively, this study showed there was an increase in aggregate morphine usage but due to low power was not statistically significant. Qualitatively, paramedics in Monroe County, NY felt that standing orders have

changed practice in paramedic pain management and will improve prehospital patient care. Further research is needed to evaluate the effect of standing orders on morphine administration.

53. PASS TO THE STROKE CENTER-PATCHING FOR ACUTE STROKE SYNDROME John J. Glasheen, Jordan Chenkin, Norm Lambert, Richard Verbeek, Sunnybrook-Osler Centre for Prehospital Care, Toronto, Ontario, Canada

Introduction. Appropriate triage of patients with acute stroke syndrome to a stroke center is vital to facilitate rapid investigation and thrombolytic therapy for eligible patients. In our EMS system, paramedics patch to a base hospital physician (BHP) to validate their decision to triage patients to a stroke center after applying a standardized prehospital stroke triage tool. We sought to determine the proportion of patients who were denied triage by a BHP to a stroke center following a paramedic patch. **Methods.** We retrospectively reviewed stroke triage information recorded by the BHP during a paramedic patch between June 2005 and March 2007. Information recorded included the time interval since the onset of symptoms, presence of symptoms suggestive of acute stroke syndrome, and presence of contraindications to thrombolytic therapy. The data were analyzed using Microsoft Excel. **Results.** 564 completed stroke patch validation forms were reviewed. 104 (18.4%) of these cases were denied triage to a stroke center by the BHP. The majority were denied because the interval from time of onset of stroke symptoms could not be verified or was >2 hrs [46/104 (44.2%)]. 26/104 (25.0%) were denied because the patient had no signs and symptoms of acute stroke as described by the triage tool, while 42/104 (40.4%) had the presence of a contraindication to tPA administration. Some patients had a combination of time of onset >2 hours and no signs or symptoms of acute stroke [8/104 (7.7%)] or time of onset >2 hours and the presence of a contraindication to tPA [4/104 (3.8%)]. **Conclusion.** Paramedic patching to a BHP to validate a prehospital stroke triage decision decreased the number of patients triaged to a stroke center. This may have implications for stroke center caseload and resource allocation. Most patients who were denied triage by the BHP were ineligible because they did not meet the criterion for time of onset of stroke symptoms or had the presence of a contraindication to tPA. This may identify an opportunity for improvement in paramedic education.

54. EMT COMBITUBE AND OUTCOMES AFTER OUT-OF-HOSPITAL CARDIOPULMONARY ARREST Charles E. Cady, Matthew Weaver, Ronald G. Pirrallo, Henry E. Wang, Medical College of Wisconsin, Milwaukee, WI, United States of America

Objective. While Emergency Medical Technicians (EMT) in select EMS agencies use the Combitube for the airway management of out-of-hospital cardiopulmonary arrests (OOHCA), the effect of this intervention on OOHCA survival is not known. We compared the outcomes of OOHCA receiving EMT-placed Combitube with those receiving paramedic endotracheal intubation (ETI). **Methods.** Retrospective analysis of adult (>21 years) OOHCA from a large, urban, county-based, EMS system for the years 1997–2005. In this tiered response system, EMTs placed a Combitube in OOHCA patients if they arrived before paramedics. Paramedics managed the airway primarily with ETI. We included only cases where rescuers successfully placed a Combitube or ETI on the first effort. We excluded cases with failed or multiple airway efforts, or where rescuers did not place an advanced airway. We examined the following outcomes: return of spontaneous circulation (ROSC), survival to hospital admission and survival to hospital discharge. We evaluated the associations between OOHCA outcomes and airway type (Combitube vs. ETI) using propensity score-adjusted logistic regression, accounting for age, sex, witnessed arrest, bystander CPR, bystander AED, ECG rhythm, number of rescue shocks and response time. **Results.** Of 7,010 adult OOHCA, we excluded 747 cases without airway insertion and 441 cases involving failed or multiple airway efforts. Of the remaining 5,822 OOHCA, 1,487 (26%) received EMT Combitube and 4,335 (74%) received paramedic ETI. Outcomes included ROSC 2,066 (35%), survival to admission 1,489 (25.6%) and survival to discharge 376 (6.5%). Response time was shorter for paramedic ETI than EMT Combitube (5.0 min vs. 5.8 mins, $p < 0.001$). Compared with paramedic ETI, EMT Combitube was not associated with ROSC (adjusted OR 1.00; 95% CI: 0.88–1.14), survival to hospital admission (adjusted OR 1.03; 95% CI: 0.90–1.19), or survival to hospital discharge (adjusted OR 1.02; 95% CI: 0.79–1.31). All models demonstrated good fit (Hosmer-Lemeshow $p = 0.45$ –0.71). **Conclusions.** Compared with paramedic ETI, EMT Combitube was not associated with improved survival after OOHCA. The type of out-of-hospital airway may not affect OOHCA outcomes.

55. MECHANICAL CHEST COMPRESSIONS VERSUS MANUAL CHEST COMPRESSIONS FOR CARDIAC ARREST: A SYSTEMATIC REVIEW AND METANALYSIS Steven C. Brooks, Blair L. Bigham, Laurie J. Morrison, Sunnybrook Health Sciences Center, Toronto, Ontario, Canada

Background. The effectiveness of powered, mechanical chest compression devices for cardiac arrest is unclear. We undertook a systematic review to determine the effect of mechanical chest compressions versus

standard manual chest compressions on neurologically intact survival in cardiac arrest. **Methods.** Databases were searched from 1960-May 2007 (Cochrane Central Register of Controlled Trials, MEDLINE, EMBASE, Clinicaltrials.gov registry, International Standard Randomized Controlled Trial Number Register, Science Citation abstracts, Biotechnology and Bioengineering abstracts). The bibliographies of included papers were hand-searched. Two reviewers independently assessed citations for inclusion using predetermined criteria and then abstracted data. We included randomized, quasi-randomized and cluster-randomized controlled trials comparing mechanical chest compressions to standard manual chest compressions in patients with atraumatic cardiac arrest. The quality of the selected studies was independently evaluated by two authors. Statistical heterogeneity was explored using Cochrane's Chi-square Test of homogeneity and the I-squared statistic. A random effects model was used to provide pooled estimates of relative risk where data allowed. **Results.** Four trials, with data from 868 patients, were included in the review. The quality of included studies was poor and clinical heterogeneity was observed between studies (prehospital vs in-hospital setting, duration of cardiac arrest prior to randomization, type of compression device, and outcome measures). One study (N = 767) reported lower neurologically intact survival to hospital discharge rates with mechanical devices suggesting that they may be harmful (3.1% mechanical vs 7.5% manual, $p = 0.006$). Conversely, other studies suggest mechanical devices may increase return of spontaneous circulation (2 studies, N = 51, pooled RR 2.81 95% CI: 0.96–8.22) and survival to hospital admission (1 study, N = 17, RR 4.13, 95% CI: 0.19–88.71). There are no data on long-term outcomes or the quality of cardiopulmonary resuscitation (CPR) in the control arm. **Conclusions.** There is insufficient evidence to conclude on the effectiveness of mechanical chest compression devices. Methodological heterogeneity and lack of reporting on the quality of CPR may explain conflicting results. More data from randomized controlled trials that standardize and measure CPR process in the control arm and employ similar outcomes are needed to clarify the effect of mechanical chest compression devices in cardiac arrest.

56. PREHOSPITAL INTUBATION IN CARDIAC ARREST, A COMPARISON OF SURVIVAL Don L. Custodio, Joshua Egly, Nathan Bishop, Michael Prescott, Raymond Jackson, Robert Swor, William Beaumont Hospital, Royal Oak, MI, United States of America

Purpose. There is a developing body of literature documenting adverse survival outcome of out-of-hospital endotracheal intubation for critical multiple trauma and head injury patients. Our objective is to compare

survival to hospital admission and discharge of non-traumatic Out-of-Hospital Cardiac Arrest (OHCA) patients who received successful endotracheal intubation to those not intubated. **Methods.** We conducted a retrospective study from an ongoing database of OHCA patients brought to a large suburban tertiary care emergency department by paramedic services between 1995 and 2006. We dichotomized patients by whether they were successfully intubated (ET) or not prior to hospital arrival. Utstein style cardiac arrest variables were abstracted for all cases. All survivors to admission were reviewed to exclude those patients who had a successful first shock recovery of spontaneous circulation or other reasons that intubation was not attempted. Univariate and multi-variate analysis was performed using survival to admission and discharge as outcomes. **Results.** There were 1,515 total cases with 34 early survivors excluded. Overall, 1,234 (86.5%) were intubated, 274 (20.3%) survived to admission, and 101 (7.3%) survived to discharge. We did not observe a difference in Scene time intervals between intubated and non-intubation groups (25.7 + 13.8 vs. 26.2 + 16.6, $p = 0.74$). After we dichotomized patients by initial cardiac rhythm, a univariate analysis shows intubation did not impact survival to admission for VF patients (28.0% vs. 30.1%, $p = 0.7$), but decreased survival to discharge (11.6% vs. 21.1%, $p = 0.025$). In a multivariate Logit model, intubation significantly decreased survival to discharge, OR adj = 0.52 (0.27–1.0). Intubated non-VF patients were more likely to survive to admission OR adj 2.9 (1.0–8.3) but not to discharge (1.8% vs. 1.0%, $p = 0.49$). **Conclusion.** This observational study in an unselected population suggests pre-hospital endotracheal intubation for non-traumatic cardiac arrest patients does not improve survival to hospital discharge. Furthermore, ET intubation had worse outcome for VF patients but showed a benefit to admission in non-VF patients. Future prospective studies are needed to define the role of ET intubation in cardiac arrest patients.

57. METABOLIC DEMANDS ON THE RESCUER DURING CARDIOPULMONARY RESUSCITATION Stacy Reynolds, John Rittenberger, Steven Reis, Joe Suyama, David Hostler, University of Pittsburgh, Pittsburgh, PA, United States of America

Introduction. The updated American Heart Association guidelines for CPR stress the importance of performing high quality chest compressions to generate coronary perfusion pressure. However, the metabolic demands of high quality CPR for the rescuer are unknown. **Objective.** To identify the metabolic demands when performing chest compressions in health care providers at various compression rates by measuring changes in heart rate (HR), respiratory rate (RR), and oxygen consumption (V02). **Methods.** This study

evaluated 15 BLS certified subjects with a cross over design. Subjects completed an exercise stress test to establish maximal $\dot{V}O_2$. Subjects then performed CPR in three separate sessions with continuous computer feedback, correcting compression depth and chest release, at continuous compression rates of 80, 100, and 120 per minute. An open circuit spirometer was used to measure $\dot{V}O_2$, carbon dioxide production ($\dot{V}CO_2$), RR, and respiratory exchange ratio (RER) every minute during 5 minutes of CPR and five minutes of recovery. HR was recorded at one minute intervals via a non-invasive chest probe. Data were analyzed using descriptive statistics and general estimating equations. **Results.** Subjects were aged 30.6 ± 3.4 years with a relative $\dot{V}O_{2max}$ of 44.6 ± 7.5 ml/kg/min. Peak $\dot{V}O_2$ during CPR was 33.3 ± 9.1 % of $\dot{V}O_{2max}$. No differences were noted between the 80, 100, and 120 compressions/min groups for RR (24 ± 6 , 24 ± 6 , 23 ± 4 breaths per minute) and peak $\dot{V}O_2$ (13.9 ± 4.4 , 13.8 ± 2.7 , 13.8 ± 2.4 mL/kg/min). HR was higher at 120 compressions/min (117 ± 20) when compared to 80 compressions/min (104 ± 16) ($p < 0.05$) but did not differ at 100 compressions/min (111 ± 14). **Conclusions.** In this group of fit providers, peak $\dot{V}O_2$ during CPR did not vary by compression rate although a higher HR was required to sustain 120 compressions per min. The difference in $\dot{V}O_2$ may be underestimated in the average health care worker due to the overall fitness of the cohort studied.

58. WORK OF CPR DURING TWO DIFFERENT COMPRESSION TO VENTILATION RATIOS Amy Betz, Clifton Callaway, Brian Suffoletto, David Hostler, Jon Rittenberger, University of Pittsburgh, Pittsburgh, PA, United States of America

Background. The 2005 CPR guidelines recommend a compression to ventilation ratio of 30:2. The effect of additional work on the provider and on CPR quality is unknown. We hypothesize that the increased compression to ventilation ratio of 30:2 will increase rescuer work and decrease quality of compressions. We compared health care provider CPR performance with compression to ventilation ratios of 15:2 and 30:2. **Methods.** Eighteen CPR-certified health care providers performed five minutes of chest compressions on a manikin with compression to ventilation ratios of 15:2 or 30:2 on two separate sessions. The manikin chest spring was replaced with a stiffer version to provide more realistic chest compliance. Heart rate, OMNI scale of perceived exertion, and capillary lactate were recorded before and after each session. Subjects were given continuous, automated, feedback from an accelerometer that measured the rate, depth, duration, and release of compressions. Compression measurements and feedback messages were recorded contin-

uously during each five minute session. Data were analyzed using descriptive statistics and t-test to compare groups. **Results.** Peak heart rate (102 ± 24 vs. 106 ± 27), OMNI (4.3 ± 1.2 vs. 4.6 ± 1.1), and lactate (2.2 ± 0.95 vs. 2.2 ± 0.96) was higher at the end of 5 minutes of CPR, but did not differ between 15:2 and 30:2. Depth of compression (38.8 ± 3.6 vs. 38.2 ± 2.9) and number of feedback prompts (48 ± 55 vs. 64 ± 70) did not differ between 15:2 and 30:2 groups or at any of the minutes of CPR. As expected, total (SD) compressions were higher ($p < 0.05$) in the 30:2 (457 ± 43) compared to 15:2 (379 ± 28). **Conclusions.** Increasing the CPR ratio from 15:2 to 30:2 does not change rescuer effort or perceived exertion during a 5-minute bout of CPR when continuous feedback is provided. Although there was considerable inter-subject variation, the 30:2 ratio resulted in more chest compressions per minute without decreasing CPR quality.

59. RAPID DEPLOYMENT OF A MECHANICAL CPR DEVICE IMPROVES SHORT-TERM SURVIVAL IN OUT-OF-HOSPITAL CARDIAC ARREST—A SINGLE CENTER EXPERIENCE Don Lundy, William Todd McGeorge, Annemarie E. Silver, Gary A. Freeman, Charleston County EMS, N. Charleston, SC, United States of America

Purpose. The prognosis for patients suffering from out-of-hospital cardiac arrest is remarkably poor; therefore, there is tremendous need for advancements in the treatment of cardiac arrest. The current study was conducted to determine whether use of the AutoPulse® (ZOLL Medical Corporation), a mechanical CPR device, improves short-term survival (STsurvival) in patients suffering from out-of-hospital cardiac arrest and to determine whether speed of deployment influences outcome. **Methods.** A retrospective analysis of 600 consecutive out-of-hospital cardiac arrest patients treated and transported by Charleston County EMS between January 2004 and December 2006 was conducted. During the study period, 284 patients were treated with AutoPulse® mechanical chest compressions (A-CPR), whereas 316 were treated with manual chest compressions (M-CPR). STsurvival, the primary outcome, was defined as palpable spontaneous pulses upon arrival at the emergency department. **Results.** Patients treated with A-CPR and M-CPR did not significantly differ in age (65 ± 16 vs. 65 ± 17 years; mean \pm SD, $p = 0.7$), time to EMS arrival (10.5 ± 3.8 vs. 11.0 ± 4.4 min, $p = 0.1$), gender (62 vs. 62% male, $p = 0.9$), incidence of bystander CPR (15 vs. 14%, $p = 0.6$), incidence of witnessed arrest (52 vs. 58%, $p = 0.2$), or initial presenting rhythm (25 vs. 29% ventricular fibrillation/tachycardia; 53 vs. 48% asystole; 22 vs. 23% PEA, $p = 0.4$). Although not reaching statistical significance, STsurvival was greater in patients treated with A-CPR compared

with M-CPR (23 vs. 19% M-CPR; $p = 0.17$). The A-CPR patients with positive STsurvival received AutoPulse compressions earlier compared with patients with STnon-survival (5.0 ± 4.5 vs. 7.5 ± 6.8 minutes to AutoPulse application after EMS arrival, $p = 0.01$). STsurvival was superior in patients receiving rapid A-CPR (i.e., A-CPR within 6 minutes of EMS arrival) compared with M-CPR (32 vs. 19%, $p = 0.003$). Moreover, logistic regression revealed that the time from EMS arrival to AutoPulse deployment was a significant predictor of STsurvival (OR = 0.92, 95% CI: 0.86–0.98, $p = 0.006$). **Conclusions.** In out-of-hospital cardiac arrest patients, early application of the AutoPulse, a mechanical CPR device, improves short-term survival. This study highlights the importance of rapid AutoPulse deployment. Because this was a non-randomized study and there were no long-term survival data, a future study will be required to further elucidate the influence of AutoPulse use and deployment timing on patient outcome.

60. SURVEY OF ATTITUDES AND BARRIERS TO PERFORMING CPR **Alex Mangili, Francis X Guyette, III,** *University of Pittsburgh, Pittsburgh, PA, United States of America*

Introduction. Previous studies regarding bystander CPR in the setting of witnessed cardiac arrest have identified barriers to the public's willingness to perform CPR. Results of these studies vary based on the location and population studied. We sought to characterize the attitudes of Pittsburghers towards bystander CPR with regard to chest compressions, AED use, and rescue breathing. We described differences the public's attitudes with regard to performing CPR on strangers or acquaintances. **Objective.** To describe the circumstances under which laypersons will perform CPR and identify barriers to the delivery of bystander CPR. **Methods.** We conducted a convenience sample survey of 345 individuals attending public events in the City of Pittsburgh. Subjects were aged from 18 to 85. Participants were asked to complete 18 multiple choice questions. Data were analyzed using descriptive statistics. **Results.** We analyzed 345 surveys. 54% of participants were female and 66% had some CPR training. Among those who knew CPR, only 54% (95% CI: 49–59) reported feeling comfortable with performing CPR. 87% (83–90) of all respondents indicated that they would "likely" or "definitely" perform chest compressions on a stranger while only 73% (68–77) would perform rescue breathing. Participants indicated that they would be more likely to perform chest compressions (94%, 91–96) and rescue breathing (90%, 86, 92) on coworkers. Pittsburghers were most likely to perform chest compressions (96%, 94, 98) and rescue breathing (97%, 95–98) on family members. 30% (23–34) of respondents

had current CPR cards and 23% (18–28) stated that it was required for their job. Only 27% (22, 33) claimed to know how to use an AED. When asked about barriers to performing CPR 50% cited lack of training or knowledge. Surprisingly, 36% of respondents voiced concern about liability and a minority were concerned about hygiene (18%) and infectious disease (16%). **Conclusion.** Our findings indicate that Pittsburghers are more likely to perform chest compressions than rescue breathing, more likely to assist relatives and friends, and most likely not to perform CPR due to a perceived lack of adequate training.

61. THE FEASIBILITY OF PREHOSPITAL BISPECTRAL ELECTROENCEPHALOGRAPHY IN TRAUMATIC BRAIN INJURY **Daniel P. Davis,** *University of California-San Diego, San Diego, CA, United States of America*

Background. Objectively measuring mental status is critical in the prehospital management of patients with traumatic brain injury (TBI). Glasgow Coma Scale (GCS) is commonly employed but is not continuous and has poor discriminative ability and low inter-observer reproducibility. Bispectral electroencephalography (BIS) is a continuous measure of level of consciousness that has demonstrated excellent predictive ability in the ED for TBI patients. The utility of BIS in the prehospital environment remains to be determined. **Objectives.** To explore the feasibility of utilizing BIS to assess level of consciousness in prehospital TBI patients. **Methods.** This was a pilot study focusing on the technical challenges and potential utility of BIS in the field. BIS measurements were applied in a convenience sample of TBI patients transported by air medical crews. Clinical data, including the initial, highest, and lowest BIS values, and administration of sedatives and paralytics were documented. In addition, the utility of BIS and any technical challenges were reported by air medical crews. **Results.** A total of 15 patients were included in this analysis. The mean initial, lowest, and highest BIS scores were 61, 54, and 81 among 6 patients who received sedation prior to the initial recorded value. The mean initial, lowest, and highest BIS scores were 94, 81, and 98 among 9 patients not receiving sedation. Moderate correlation ($r = 0.71$, $p < 0.05$) between initial GCS and BIS score was observed. Technical limitations rendered BIS useless in 3 patients (20%) but were completely absent or minimally present in 9 patients (60%). Of the remaining 12 patients, crews reported that BIS was useful for continuous monitoring of level of consciousness in 11 patients (92%) and contributed to the decision to resedate in 2 patients (17%). **Conclusions.** Prehospital BIS monitoring demonstrated usefulness with a fairly low incidence of technical limitations when employed in TBI patients transported by air medical crews. Validation with outcomes data, including head injury severity

and mortality, is important to further establish the predictive ability of BIS.

62. DISCRIMINATORY ABILITY OF S100 PROTEIN TO PREDICT INTRACRANIAL LESION AND CLINICAL OUTCOMES AFTER TRAUMATIC BRAIN INJURY Yu Jin Kim, Sang Do Shin, Ki Ok Ahn, Jin Seong Cho, Ju Ok Park, Kyoung Jun Song, Gil Joon Suh, Sung Chun Kim, Seoul National University Hospital, Seoul, Seoul, Seoul, Republic of Korea

Purpose. This study was conducted to know discriminatory ability of S100 protein to predict intracranial lesion and clinical outcomes after traumatic brain injury. **Methods.** Data were prospectively collected at two urban emergency departments, on the demographics, injury-related factors, and clinical outcomes of suspected traumatic brain injury victims older than 15 years old from May to October 2006. We also measured serum S100 protein level immediately at the time after visiting to ED, using an electrochemiluminescence immunoassay kit (Elecsys[®] S-100; Roche Diagnostics, Mannheim, Germany). We also measured S100 protein level from healthy volunteers for getting normal value. Radiologic results were used as gold standard compared to S100 protein level. Death at hospital and Glasgow Outcome Scale (GOS) after 6 months was investigated as primary and secondary outcome. For estimation of discriminatory power to predict intracranial lesion, hospital death, and GOS, we measured area under the receiver operating characteristic curve (AUC). This study was approved by the Institutional Review Boards and informed consents were obtained from patients or their relatives. Results The total number of patients and healthy volunteers was 254 (mean age, 44.2 ± 18.9 years), 147 (mean age, 36.7 ± 8.7 years), respectively. The final outcome was as follows: discharge (69.7%), transfer to another hospital (9.1%), admission (19.3%), and death at hospital (2.0%). The proportion of patient with intracranial lesion and with good GOS (≥ 4 point) was 24 (9.5%) and 14 (8.6%) among successful following-up cases (N = 162), respectively. Major intervention was done in 9 cases (3.5%), including operation and neuroangio-intervention. Serum S100 protein levels of patient with intracranial lesion (N = 24) were significantly higher (1.98 ± 3.35 ug/L) than those of patients without intracranial lesion (N = 230) and of healthy volunteers (N = 147) (0.42 ± 1.11 ug/L and 0.08 ± 0.04 ug/L, respectively). The AUC for discrimination between patients with and without intracranial lesion, between death and survival, between major outcomes being occurred and not being occurred, and between good and poor neurologic outcome was 0.77, 0.81, 0.84, and 0.74, respectively. **Conclusion.** Serum S100 protein level for discriminatory power to predict the diagnosis of intracranial lesion, hospital death, major outcomes,

and neurologic outcome after 6 months was relatively high.

63. EVALUATION AND COMPARISON OF TOURNIQUETS FOR HEMORRHAGE CONTROL Phillip L. Coule, Dustin J. Calhoun, Medical College of Georgia, Augusta, GA, United States of America

Purpose. Use of tourniquets (TKs) has general implications for EMS systems, in particular for disaster and tactical EMS. Traditional TK application has required proximal to the joint application; many EMS systems do not carry commercial TK's. This study compares proximal vs. distal placement of TK's and the efficacy of various commercial TK's and improvised TK's. **Methods.** Sixty-four (64) EMS volunteers was randomized to one of seven TKs, four commercial TKs (Combat Application TK, CAT; Mechanical Advantage TK, MAT; Tournikwik; Self Applied TK System, SATS) and three improvised techniques (Belt/stick, cravat/stick, kerlix/stick). The device was applied by both the volunteer and a second volunteer, in random order, to a lower extremity and the dominant upper extremity, above and below the knee/elbow. Arterial occlusion was measured using a Doppler stethoscope at the radial and doralis pedis arteries. Data collected included: occlusion time, securing time, occlusion success, pain, application ease, device malfunction, prior training with improvised techniques, and anecdotal observation. **Results.** A mixed model analysis of variance was used to examine differences between TK types and location of application, (p < 0.05). The CATTM and the MATTM were statistically superior twice as often as the next best TK (p < 0.05), but no single TK was superior in all areas of analysis. Additionally the CAT and MAT were never shown to be inferior in any comparison (p < 0.05). Commercial TKs as a group have shorter application times, higher occlusion rates, and are easier to apply (p < 0.05). For each TK type, no difference in occlusion rate was seen when applied above or below the elbow/knee (p < 0.05). **Conclusions.** The efficacy of commercial TKs is clearly superior to that of improvised techniques. Consideration should be given to equipping EMS personnel with commercial TKs. Among the devices examined, the CATTM and the MATTM were clearly the most effective devices. The weight and storage volume of the CATTM give it significant advantages in the tactical setting. Finally with distal application, no reduction in occlusion rates was seen. TK s should be placed distal to joints when possible to maximize preserved limb function.

64. USE OF THE HEMCON[®] BANDAGE FOR EXTERNAL HEMORRHAGE CONTROL IN A CIVILIAN EMS SETTING Mark Stevens, Mohamud R. Daya, Scott Sullivan, Corie Depuy, Tualatin Valley Fire & Rescue, Aloha, OR, United States of America

Purpose. The Hemcon[®] Bandage is a hemostatic dressing made of chitosan, a natural substance derived from chitin, that adheres when in contact with blood. The purpose of this study is to determine the effectiveness of the Hemcon[®] bandage in a civilian EMS system. **Methods.** The Hemcon[®] Bandage was added to the trauma kits on all responding vehicles of a mixed urban-suburban fire agency. The agency provides first response ALS service to nine incorporated cities and approximately 418,000 individuals. Training was accomplished through multimedia presentations. Bandages, which are available in three sizes (4" × 4", 2" × 4", and 2" × 2") were to be used when conventional treatment (pressure/gauze dressing) failed, or for obvious arterial bleeding. After each use, EMS personnel completed a survey documenting wound characteristics and approximate time to cessation of bleeding. Outcome variables and patient demographics were abstracted and entered into an MS Excel spreadsheet. Descriptive analyses were performed. **Results.** Over a two year period, the bandage was used 74 times and complete survey data was available in 70 cases. The majority of wounds were located on the head/neck (40%) and the arm/hand (39%). Patient ages ranged from 8 to 93 and 67% were male. The bandage was used after conventional methods had failed in 81% of cases. The bandage successfully controlled external hemorrhage in 77% of cases with the majority (91%) within 3 minutes of application. Bandage failure was attributable to improper application (63%), inability to access all bleeding surfaces (44%), and interference with adherence properties (13%). More than one factor was responsible in some cases. Success rates with the thicker first generation bandage (4" × 4") improved from 75% in year 1 to 93% in year 2 of the study. The thinner second generation bandages (2" × 2" and 2" × 4") which became available in year two, were successful in 14 out of 20 cases (70%). **Conclusions.** The Hemcon[®] Bandage stops uncontrolled external hemorrhage when conventional methods such as pressure or gauze dressings fail with a success rate of 77% in a civilian EMS setting.

65. EXTERNAL VALIDATION OF CLINICAL SPINE CLEARANCE CRITERIA FOR SELECTIVE PREHOSPITAL SPINE IMMOBILIZATION Yu Jin Kim, Sang Do Shin, Ki Ok Ahn, Jin Seong Cho, Sung Chun Kim, Ju Ok Park, Kyoung Jun Song, *Seoul National University Hospital, Seoul, Seoul, Seoul, Republic of Korea*

Purpose. We validate clinical spine clearance criteria for selective out-of-hospital spine immobilization and evaluate appropriateness, according to those criteria, of the spine immobilizations performed in the field. **Methods.** This was a 20-month double blinded prospective study. Targets were patients with trauma

who were transported to a regional emergency center by emergency medical technicians in Korea. If any of the 8 criteria, altered mental status, evidence of intoxication, neurological deficit, suspected extremity fracture, cervical pain, cervical tenderness, thoraco/lumbar pain, and thoraco/lumbar tenderness, were turned out to be positive, independent hospital EMT recorded a spine immobilization was necessary. On the basis of the final diagnosis of the spine injury, the appropriateness of the immobilization was evaluated, afterward. **Results.** The study collected data of 1224 trauma victims transported by EMS. 50 (4.1%) out of 1224 patients were diagnosed with spinal fracture or spinal cord injury, 44 of them were assessed as positive in the necessity of spinal immobilization by the criteria. Sensitivity, specificity, positive predictive value, and negative predictive value were 88.0%, 34.9%, 5.4%, and 98.6%, respectively. On the other hand, among the 802 patients judged with necessity of immobilization, 560 were underprotected without spinal immobilizations (69.8%) and among the 361 patients judged immobilization was unnecessary, 35 over-protected (9.7%). **Conclusion.** Clinical spine clearance criteria were useful to judge the need of out-of-hospital spine immobilization, and to predict spinal injuries. If they can be applied to the emergency medical services system of Korea, it will contribute to perform appropriate spine immobilization.

66. PREVENTABLE AND NON-PREVENTABLE REASONS FOR PROLONGED SCENE TIME IN TRAUMA PATIENTS Alex Garza, Matthew Gratton, James McElroy, Daniel Lindholm, Rex Archer, Joseph Salamone, *Washington Hospital Center, Falls Church, VA, United States of America*

Objectives. Decreasing time to definitive care improves survival in trauma patients. Delays in transport from the scene increases time to definitive care. If reasons for delay can be identified, measures might be taken to decrease out of hospital scene times (ST). We describe the reasons cited by EMT-PS for prolonged ST for patients requiring routing to a trauma center. **Methods.** Setting: Urban, all ALS ambulance service with 90,000 calls and 60,000 transports annually. Design: Prospective, observational, descriptive study over 12 months. Inclusion criteria: All calls meeting criteria for trauma center routing with ST > 10 minutes. EMT-PS with ST > 10 min documented the reason for delay using a standardized incident report form. Prolonged scene time reports were categorized as either a "preventable" or "non-preventable" by the QI manager and EMS medical director. Data Analysis: Count data and frequencies for explanations are reported. **Results.** There were 577 calls that required routing to a trauma center during the study period. Of these 197 (34.49%) had a ST > 10 minutes. For calls with ST > 10 minutes; 33 (17.26%) had

“preventable” and 164 (82.74%) had “non-preventable” delays in patient transport. Of the preventable causes, the most prevalent reasons were police delaying transport to question the victim (26.47%) and adequate resources not on scene (20.59%). Of the non-preventable causes, the most prevalent reasons were combative patient (22.09%) and access to the patient (21.47%). Additionally, 7.36% of the nonpreventable scene delays had multiple reasons for delay. **Conclusions.** The majority of reasons for transport delays of patients requiring routing to a trauma center are not preventable. Although efforts to reduce prehospital ST of trauma patients should focus on preventable causes, it may be difficult to reduce the number of ST delays given the large percentage of non-preventable causes.

67. QUALITY IMPROVEMENT STRATEGIES IMPROVE SCENE TIME COMPLIANCE FOR PATIENTS REQUIRING TRAUMA CENTER ROUTING Alex Garza, Matthew Gratton, James McElroy, Daniel Lindholm, Joseph Salamone, Rex Archer, *Washington Hospital Center, Falls Church, VA, United States of America*

Objectives. Decreasing time to definitive care improves survival in trauma patients. Out of hospital time depends on how rapidly an EMT-P removes patients from the scene. We describe the effect of a quality improvement (QI) program on scene times (ST) for patients requiring routing to a trauma center. **Methods.** Setting: Urban, all ALS ambulance service with 90,000 calls and 60,000 transports annually. Design: Prospective, observational QI study. Subjects: All patients meeting trauma center routing criteria. Pre-intervention phase was 13 months and post intervention phase was 12 months. Intervention: During the pre-intervention phase, EMT-Ps with ST > 10 minutes were sent a memo from the QI manager requesting an explanation for transport delay. During the post-intervention phase, EMT-Ps received a memo from the QI manager stating the Medical Director requests an explanation for transport delay; explanations were categorized as “preventable” or “non-preventable” by the QI manager and Medical Director; EMT-P’s with “preventable” causes received reeducation from the QI director. During both phases, trauma ST and trends were displayed for EMT-Ps to review. Data Analysis: Average ST and percentage of calls with ST > 10 minutes per month were calculated. 95% CI’s and t-test for significance were calculated. Tests for significance were two tailed with alpha = 0.05. **Results.** There were 575 and 577 patients during the pre-intervention and post-intervention phase respectively. The average ST per month was 11:24 (95% CI: 10:39–12:09) pre-intervention and 10:12 (95% CI: 9:24–11:00) postintervention (p = NS). The percentage of calls with ST > 10 minutes per month was 47.54% (95% CI: 42.01–53.07) preintervention and 34.47% (95% CI:

29.73–39.21) postintervention (p < 0.002). **Conclusions.** A QI program resulted in a noticeable, but not statistically significant decrease in average ST and a significant decrease in the percentage of trauma center routed patients with ST > 10 minutes.

68. CLINICAL BENCHMARKS IN EMS: DO THE NUMBER OF EMS PROVIDERS IN THE SYSTEM AFFECT THEIR CRITICAL CARE PATIENT INTERVENTIONS? Kristin Vrotsos, Clare Guse, Ronald G. Pirrallo, Tom P. Aufderheide, *Medical College of Wisconsin, Milwaukee, United States of America*

Introduction. Competency is affected by skill exposure, skill complexity and training program quality. Literature shows that within 6 to 12 months of initial training skill deterioration occurs. Benchmarking is one tool that can provide ongoing evaluation to maintain quality and proficiency among EMS providers. The purpose of this study was to reevaluate the biennial critical care skill and experience benchmark thresholds established by the Milwaukee County EMS (MCEMS) system in 1997. **Methods.** This study is a retrospective review of paramedics working during 2001–2005 using the MCEMS patient care record (PCR) database. A paramedic profile is produced annually generated from their assigned identifying number on the PCR documenting their role in the successful completion of a patient care intervention. The number of patient contacts, role as team leader/report writer; adult and pediatric endotracheal intubations, adult and pediatric intravenous access, medication administration and 12 lead ECG acquisitions were analyzed. These skills/experiences were selected to include low frequency, high patient harm potential events and/or high difficulty technical skills. T tests and descriptive statistics were performed for comparison to the 1997 study. **Results.** Over the five year study period, 1,215 paramedic profiles gleaned from 107,524 PCRs documented a total of 297,900 patient contacts. Annual means + SD [range] were as follows: patient contacts 245 + 133 [12–788], team leader: 106 + 119 [0–739], intubations: adult 2.57 + 2.54 [0–20]; pediatric 0.1 + 0.3 [0–3], IV starts: adult 44 + 37 [0–267]; pediatric 0.34 + 0.77 [0–5], treated cardiac arrests: adult 8 + 6 [0–34], pediatric 0.26 + 0.61 [0–4], hypotensive trauma treated: 5 + 6 [0–42], ECGs acquired: 31 + 19 [0–144]. The 1997 analysis (1987–1996 data) included 1,450 paramedic profiles representing 467,559 patient contacts generated from 172,131 filed PCRs. Patient contacts and reports written demonstrated immense ranges similar to the current study. All comparable skill and experience frequencies decreased significantly between the 1997 analysis and the current study except medication administration which increased significantly by 25%. **Conclusion.** These data show immense variability

in successful completion of technical skills and experiences among providers in this EMS system. Of equal concern is the limited exposure to critically ill adult and pediatric patients, reaffirming that high risk skills are performed infrequently. This suggests that a multifaceted approach should be considered for maintaining provider competency.

69. DOES PATIENT-SELECTED MUSIC PLAYED DURING AMBULANCE TRANSPORT DECREASE PATIENT ANXIETY? **Melinda Threlkeld, James Montoya, David French, Tom Blackwell, Carolinas Medical Center, Charlotte, NC, United States of America**

Purpose. Stress and anxiety typically increase when individuals encounter unfamiliar situations, such as ambulance transport following unexpected illness or injury. While patient-selected music has been shown to counteract stress in the hospital, this effect has not been studied in the prehospital setting. We tested the hypothesis that patients with non life-threatening, low acuity conditions who selected and listened to music during ambulance transport would have decreased perceived anxiety upon hospital arrival. **Methods.** A prospective, randomized clinical trial was conducted over 16-weeks. Following informed consent, non-critical, English-speaking, adult patients who were transported to an urban level 1 trauma center were randomly assigned to the control (no music) or intervention (music) group. Patients in both groups completed a previously validated 6-item short form of the Spielberg State-Trait Anxiety Inventory (STAI) before and after transport. Patients in the intervention group chose one of 6 categories of music (Billboard Top-10 at the time of the study) which was played during transport. Patients in the control group were transported according to standard protocol. Paired t-test comparisons were performed, with significance defined as $p < 0.05$. **Results.** A total of 137 patients were enrolled, 68 patients in the control group and 69 in the intervention group. There was no significant difference in STAI scores between the control and intervention groups pre-transport (53.1 vs. 48.4, $p = 0.083$) or post-transport (44.8 vs. 41.4, $p = 0.163$), or change in scores following transport (8.3 vs. 7.0, $p = 0.553$). Scores were compared between medical versus trauma etiology. While there was no difference during transport between control and intervention groups in medical patients (6.2 vs. 8.1, $p = 0.452$), trauma patients did demonstrate a significant difference (13.2 vs. 3.7, $p = 0.017$); however, patients in the control group had a larger change in score than those in the intervention group. Finally, when comparing patients who had an IV placed and those that did not, there was no significant difference in scores between the control (-12.2 vs. -8.1, $p = 0.208$) and intervention (-6.7 vs. -6.3, $p = 0.907$) group. **Conclusion.** Patients in this study who selected and listened to music during

ambulance transport did not decrease their perceived anxiety levels using a validated STAI score.

70. STRATEGIC HIGHWAY SAFETY PLANS: WHERE IS EMS? **Nadine Levick, Heidi Cordi, EMS Safety Foundation, New York, NY, United States of America**

Background. All States are mandated to generate a Strategic Highway Safety Plan (SHSP) to respond to the Safe, Accountable, Flexible, Efficient Transportation Equity Act: A Legacy for Users (SAFETEA-LU), and to be effective October 1st, 2007. Plan guidance supplement SAFETEA-LU requirements April 5, 2006 recommended multi-agency, multidisciplinary development committees. The SHSPs are required to encompass: Engineering, Enforcement, Education and Emergency Medical Services (EMS). While each of the 4Es is equally important, EMS is the most recent addition and is often underutilized by highway safety professionals when identifying safety partners, emphasis areas, and strategies. **Objective.** To identify the scope and nature of the EMS components of the SHSPs developed by each State. **Methodology.** Draft State SHSPs, written subsequent to SAFETEA-LU and the enabling legislation (Subtitle D - Highway Safety, SEC 1401 Highway Safety Improvement Program, Section 148 of title 23 United States Code), from April 5th 2006, to July 10th 2007, were identified via electronic search of State government, other transportation information resources and web sites. Each SHSP was searched for EMS representation, an EMS section, and any references to EMS. The identified EMS components were categorized and compared. **Results.** Drafts for only 24/50 States SHSPs were identified during the study period, of which 20/24 had no EMS specified section, 3/24 had an EMS section of $\geq 10\%$ of the total document, the remainder had $<10\%$ of the document focused on EMS. EMS representation was not specifically identified on all SHSP development committees. In the plans with an EMS section, the categories addressed were not consistent across plans; some focused on EMS training, dispatch, and response, and others on funding and other issues. No field of EMS focus was common to all plans. **Conclusion.** The State SHSPs evaluated reflected a varied involvement of EMS representatives, identification of diverse EMS priorities, and varied EMS-related highway safety issues. Although regional variation is expected, involvement of key EMS stakeholders should be standard in the basic development of SHSP. Consideration of uniform recommendations for the core aspects of EMS SHSP components could enhance a more substantive role of EMS in these State plans.

71. EMS TRANSPORT DIRECTLY TO THE WAITING ROOM—IS IT SAFE? **David Edward Slattery, Estrella Evangelista-Hoffman, University of Nevada School of Medicine, Las Vegas, NV, United States of America**

We sought to determine protocol compliance and patient safety outcomes in patients transported by EMS directly to a hospital's waiting room (WR). **Setting.** EMS system serving an urban and suburban population of 1.6 million. Inclusion criteria: Adult patients who EMS providers transported directly to the waiting room. Exclusion criteria: Patients who were sent to the WR by the facility's nurse or patients who were left by EMS after long off-load times. IRB approval was obtained by the two hospitals which participated in the outcomes portion of the study. During a 4 month period, WR-transported patients were prospectively identified by each transporting agency. Protocol compliance elements, and hospital outcome data were abstracted from the PCR by trained abstractors (RN-level) using a prospectively defined data collection tool and dictionary. EMS providers were not aware of the study. The EMS/hospital abstraction was performed independently to ensure blinding to the patient's other record. 10% of records were checked for data entry accuracy by the principle investigator. Data were entered into MS ACCESS, and analyzed using MS Excel. **Results.** 255 patient care records were submitted for review. 122 did not meet the inclusion criteria leaving 133 patients. 84 (63%) of these patients were transported to one of the two outcomes hospitals. 64 had matched EMS and hospital records and comprised the study cohort. EMS protocol compliance: 6/64 [9.3 (4.4;19.0) %] of the cases were protocol violations. The most common violation was for abnormal vital signs. The time [median, mean (95% CI) and range] to the first set of VS, first RN evaluation, and first physician evaluation was: 7, 15.6 (8.92,22.4) Range = 1-140 minutes; 4.5; 11.7 (6.4,16.9) Range = 1-119 minutes; 65; 143.5 (95,192); Range = 1-733 minutes. No patient died. 7 patients [12.5 (6.3;24)%] required emergent treatment. 19.6 (11.3;31.1)% were admitted, 34 (23;47)% left without being seen, and 47(34;59)% were discharged after evaluation and treatment in the ED. This study is limited by the small number of patients. **Conclusions.** Despite fairly good protocol compliance, transporting patients directly to a waiting room is not without risk. Our data may provide insight for similar EMS systems considering such a protocol.

72. EFFECTS OF IMPLEMENTATION OF ELECTRONIC EMS PREHOSPITAL CARE REPORTS (E-PCRS) **Joshua B. Gaither, Asa Margolis, Carin M. Van Gelder, Yale-New Haven Hospital, New Haven, CT, United States of America**

Objective. Electronic prehospital care reports (e-PCRs) were recently implemented in Connecticut to comply with NEMSIS-based state requirements. The purpose of this study was to compare data collected on standard handwritten PCRs (hw-PCRs) to data collected

on e-PCRs, and to determine if e-PCRs allow collection of a more uniform and complete prehospital patient care data set. **Methods.** During a retrospective chart review, convenience samples of PCRs from April and May of 2005 (hw-PCRs) and 2007 (e-PCRs) were compared. They were evaluated for the presence or absence of 78 preselected NEMSIS data points including time of patient care, medication administration, and physical exam findings documented by EMS personnel. **Results.** Data from 173 e-PCRs and 163 hw-PCRs were analyzed and statistically significant differences were demonstrated in the following fields. HW-PCRs forms documented a physical exam finding for those fields with a check box style exam in the areas of chest, abdomen, and eye in 88%, 84% and 89% of forms, while those areas of the physical exam not allotted a check box were documented less frequently: neck (0.074%), back (0.049%), and neuro (22.7%). E-PCRs which had no check box style features for physical exam were also less likely to have a documented physical exam: chest (69.0%), abdomen (42.7%), eye (62.0%), neck (34.5%), and back (42.0%). Areas on e-PCRs with increased rates of documentation compared to hw-PCR documentation included time of medication administration (77% vs 23%) and response of a patient to a medication (89% vs 41%). On e-PCRs, these data points can be selected from a drop-down style menu once a medication has been selected. **Conclusion.** Presence of checkbox fields or required secondary fields increase data collected in the prehospital setting. An electronic format allows collection of a more completed data set once a primary data point has been entered.

73. PROSPECTIVE FOLLOW UP STUDY ON PATIENTS RECEIVING TREAT-AND-RELEASE MEDICAL DIRECTIVES DURING A MASS GATHERING EVENT **Hani Ahmed Baroum, King Abdulaziz Hospital Medical City - Jeddah, Saudi Arabia, Jeddah, Saudi Arabia**

Introduction. Treat-and-Release Medical Directives protocols for paramedics were introduced to provide an efficient ambulatory care to visitors at a major metropolitan three week annual summer fair visited by over 1 million people. **Objective.** We performed a prospective follow up study on patient outcome and satisfaction of the field administration of Treat-and-Release Advance Medical Directives: Dimenhydrinate for nausea and/or vomiting, Polymyxin B for minor wounds and abrasions, Acetaminophen for uncomplicated headaches and minor musculoskeletal pain, Diphenhydramine for hay fever symptoms or isolated urticaria and fluid rehydration for heat exposure and inadequate fluid intake. **Methods.** During the event all patients presenting at an on-site medical center were treated with the appropriate medical protocols. Patients received a follow-up telephone call and/or e-mail message from study personnel, to enquire about the status

of their initial complaint through targeted questions (complaint resolved, complaint worsened, complaint persistent, EMS transfer to hospital, family physician follow up). Patient satisfaction was measured on a Likert scale with five possible answers ranging from unhappy to very satisfied. **Results.** Between August 18, 2006 and September 4, 2006, 183 of 326 (56.1%) patients treated agreed to participate in the study 146 of these patients (79.8%) completed the follow-up performed. Of these 146 patients, 79 (54%) received Acetaminophen, 21 (14%) received Dimenhydrinate, 19 (13%) received Diphenhydramine, 12 (8.2%) received Polymyxin B and 2 (1.4%) received oral rehydration solution therapy. 4 patients reported not improving after treatment. None of these patients reported worsening or transport to hospital. Unfortunately, with 37 of the 183 patients not being available for follow-up, it is possible that some adverse events may have occurred in that population. All patients were satisfied or very satisfied with treatment rendered. **Conclusion.** In this study, patients presenting to an on-site medical center with minor complaints were treated safely with special event medical directives; 100% of those that were contacted expressed satisfaction with the treatment, and there were no adverse events reported.

74. TRIAGE PERFORMANCE OF FIRST-YEAR MEDICAL STUDENTS USING A MULTIPLE CASUALTY SCENARIO PAPER EXERCISE **Robert F. Sapp, Jane H. Brice, University of North Carolina School of Medicine, Chapel Hill, NC, United States of America**

Introduction. Large-scale disaster events may overwhelm the capacity of even the most advanced emergency medical systems. When patient volume outweighs the number of available EMS providers, a mass-casualty incident may require the aid of non-medical volunteers. These individuals may potentially be utilized to perform field disaster triage, lessening the burden on EMS personnel. The purpose of this study was to evaluate the accuracy of triage decisions made by newly-enrolled first-year medical students after receiving a brief educational intervention. **Methods.** 315 first-year medical students from two successive classes participated in START triage training and completed a paper-based triage exercise as part of orientation activities. This questionnaire consisted of 15 clinical scenarios providing brief but sufficient details for prioritization. Subjects assigned each scenario a triage category of Red, Yellow, Green, or Black based on the START protocol and were allowed four minutes to complete the exercise. Participants from the Class of 2008 were provided with printed START reference cards while those from the Class of 2009 were not. Two test types varying in the order of patient age values were created to determine whether patient age was a factor in triage

assessment. **Results.** The mean accuracy score of triage assignment by medical student volunteers after a brief START training session was 64.25%. The overall rate of overtriage was 17.8%, compared to an undertriage rate of 12.6%. There were no significant differences in triage accuracy between subjects with and without printed materials (63.92% vs. 64.60%, $p = 0.729$) or those completing the age-variant test types (64.39% vs. 64.11%, $p = 0.889$). **Conclusions.** First-year medical students who received brief START training achieved triage accuracy scores comparable to those of emergency physicians, registered nurses, and paramedics in previous studies. Observed rates of under- and overtriage suggest that a need exists for improving the accuracy of triage decisions made by both medical and non-medical personnel. This study did not find that printed materials significantly improved triage accuracy, nor did it find that patient age affected the ability of participants to correctly assign triage categories. Future research might further evaluate disaster triage by non-medical volunteers.

75. EMERGENT ATROPINE RECONSTITUTION DURING A SIMULATED MASS CASUALTY INCIDENT **Robert B. Dunne, Floyd Vitale, St. Joseph Mercy Hospital, Northville, MI, United States of America**

Introduction. Preparedness for chemical events has been a challenge for emergency departments. Organophosphates have a ready antidote, but large supplies of concentrated atropine are rarely available in the emergency department (ED). The 1 mg in 10 ml typically available for cardiac uses is inadequate for intramuscular (IM) use in large numbers of casualties. In many parts of the country lyophilized bulk atropine is distributed with a plan for reconstitution in the event of an emergent need. **Objective.** To determine the time to antidote delivery in a simulated large scale organophosphate event at a busy, urban hospital **Methods.** The drill was designed to mimic a sudden event. There is a protocol for atropine reconstitution at the hospital that had never been tested. Only the two controllers were aware of the date and time. No advance notice was given to the pharmacy personnel. No additional personnel were made available. The setting is a trauma center with 82,000 ED visits and 404 beds. The drill was conducted on two different days starting with a request from the emergency department for concentrated atropine to treat a large but as yet unknown number of casualties. The timing started from this request. Each phase in preparation was recorded, as was the total time to the delivery of 50 3cc (6mg) atropine syringes with needles for IM use. **Results.** Notification to location of supplies and protocol: Trial 1–5 min. Trial 2–4 min, Reconstitution of atropine: Trial 1–6 min. Trial 2–6 min. Filling of 50 syringes: Trial 1–9 min. Trial 2–18 min. Labeling of 50 syringes: Trial 1–7 min. Trial 2–15 min. Delivery to

ED: Trial 1–2 min. Trial 2–2 min. Overall notification to delivery time: Trial 1–29 min. Trial 2–45 min. **Conclusion.** Reconstitution of lyophilized atropine is feasible in the hospital setting but time must be taken in to account when planning for a chemical event. A 45 minute supply of concentrated atropine in a ready to use form should be stocked in the ED.

76. MASS GATHERINGS DO NOT INCREASE AMBULANCE TRANSPORT RATES **Elissa Meites, John Brown,** *University of California San Francisco, San Francisco, CA, United States of America*

Hypothesis. The rate of medical events at mass gatherings is not significantly different from that predicted by the baseline for the overall population. **Methods.** The study population includes all events with an anticipated attendance of >1,000 people for which an emergency medical services plan was submitted to the Emergency Medical Services Agency of the Department of Public Health during the 12-month period August 2006–July 2007 in San Francisco County. Baseline ambulance transport rate was calculated over the year from the total number of ambulance transports in the county computer-aided dispatch system and the 2006 census population estimate. Anticipated attendance and event length were extracted from 100% of plans submitted at the time of the mass gathering (59 events). Ambulance transport data for 97% of events was obtained retrospectively from event planners and private ambulance company records. Linear regression was performed with Excel and confidence interval was calculated using the two-tailed t-test. **Results.** The baseline ambulance transport rate was 1 transport/10,000 people/12 hours, or 8×10^{-6} transports/person-hour. Baseline prediction model for transports (y) by person-hours (x): $y = (8 \times 10^{-6})x$. This model predicts the number of ambulance transports for people engaged in any activity in San Francisco. Linear regression model of mass gathering observations, predicting transports (y) by person-hours (x): $y = (2 \times 10^{-6})x$ Correlation coefficient $r = 0.42$. Root mean square error = 2.895% confidence interval for the slope $2 \times 10^{-6} = -5.6$ to $+5.6$ transports/person-hour. This model predicts, given the hourly length and anticipated attendance for a mass gathering event, the number of ambulance transports with a standard deviation of 2.8 transports. **Conclusions.** Since the 95% confidence interval for the slope in the regression model includes the overall baseline slope, we can say that the ambulance transport rate at mass gatherings is not significantly different from the baseline ambulance transport rate in San Francisco overall. Furthermore, since the 95% confidence interval for the slope includes zero, we can say that mass gatherings have no significant effect on ambulance transport rates. This calls into question the value of requiring dedicated ambulances for mass gathering

events. **Limitations.** Historical data may be more useful than population-based modeling in predicting medical needs at unique mass gathering events.

77. A REVIEW OF FIELD TREATED SHOULDER DISLOCATIONS AT A REMOTE SKI AREA **Frederick Fuller, Andrew Longstreth,** *Crystal Mountain (WA) Ski Patrol, Olympia, WA, United States of America*

Objective. To describe the experience of ski patrol staff in reducing suspected anterior shoulder dislocations at a remote ski resort. **Methods.** We reviewed all cases of suspected anterior shoulder dislocations during 5 ski seasons in which physicians or specially trained paramedics attempted relocations. Paramedics received a 1 hour in-service on identifying and managing suspected dislocations using the Milch technique. Morphine and/or a sedative was used at the discretion of the person treating the patient. A relocation attempt was defined as a closed manipulation of the shoulder joint after examination by the patrol staff. These were done both on the ski slope and in the aid room. Two blinded data abstractors, using a standardized form, systematically abstracted data from patient care records including demographics, mechanism of injury, history of dislocations, attempts, success, complications and the use of pharmacological assistance. **Results.** We identified 104 cases, 3 of which were excluded as suspected fractures that were not manipulated and 1 suspected posterior dislocation. Of the 100 remaining patients, 79 were male and 19 were female, with a mean age of 35 ± 14 . The case mix involved 41 snowboarders, 46 skiers and 38 with a prior dislocation documented. There were no differences in the paramedic success rate of 46 of 55 (84%, 95% CI: 74–93) and the physician rate of 38 out of 45 (84%, 95% CI: 74–95). Sedative and/or narcotic medicines were used in 12 of 15 (80%, 95% CI: 60–100) of the failed attempts and only 30 of 85 (35%, 95% CI: 25–46) successful cases. Fourteen out of 17 cases were successfully relocated on the ski slope without medications. The only complications recorded were procedural failures. **Conclusions.** Ski patrol staff, including paramedics, can effectively manage suspected anterior shoulder dislocations in a remote setting often without pharmacological assistance. Prospective studies should address confirmation of dislocation/relocations and complications.

78. PROLONGED TASER[®] “DRIVE STUN” EXPOSURE IN HUMANS DOES NOT CAUSE WORRISOME BIOMARKER CHANGES **Jeffrey D. Ho, Donald M. Dawes, Anne L. Lapine, William G. Heegaard, Laura L. Bultman, Mark A. Johnson, James R. Miner** *Hennepin County Medical Center, Minneapolis, MN, United States of America*

Introduction. The TASER[®] electronic control device (ECD) is used to control violent/agitated behavior in

two ways. The primary method is probe deployment. The secondary method is the "Drive Stun" (DS) which produces a painful stimulus. This project is the first to study the human effects of the DS. ECDs are scrutinized since individuals occasionally die unexpectedly following their use. Some deaths have occurred after a DS. There are cases of custodial sudden deaths when no ECD has been used, but a causal relationship is hypothesized. **Methods.** Volunteers underwent a 24 hour monitoring process. After informed consent, a health history and baseline bloodwork was obtained. Subjects then received either a 15-second or two consecutive 5 second DS applications. Applications were to the neck/shoulder region using a TASER X-26 ECD. Bloodwork was obtained after exposure and again at 8 and 24 hours after exposure. Samples were analyzed for: BUN/Creatinine ratio, Potassium, CK-MB, Lactate, and Troponin I. **Results.** 21 subjects enrolled (98.5% male, mean age 40.3 years + 6.8, range 29 to 55, mean body mass index 28.4 + 3.5, range 21.1 to 36.8). 11 had the single continuous exposure and 10 had the 2 shorter exposures. Repeated measure ANOVA showed no significant change from baseline at the four time points or between exposure types for BUN/Creatinine ratio (mean value 14.8 + 3.7, range 6.6–23, $p = 0.40$), serum potassium (mean value 4.0 mEq/L + 0.4, range 3.0–5.1, $p = 0.26$), or serum CK-MB (mean baseline value 2.45 ng/mL + 2.89, range 0–20.9, $p = 0.32$). A significant decrease in serum lactate occurred from baseline at the 8-hour time point ($p = 0.005$, baseline mean 1.87 mmol/L 95% CI: 1.39–2.35, immediate post exposure mean 1.35 mmol/L 95% CI: 1.04–1.65, 8 hour mean 1.06 mmol/L 95% CI: 0.92–1.2, 24 hour 1.22 mmol/L 95% CI: 1.1–1.4). All troponins were <0.2 mcg/L. **Conclusions.** There were no worrisome changes in the measured serum biomarkers. There was a significant decrease in serum lactate after exposure. This data does not support a causal relationship between ECD DS exposure and worsening physiology.

79. SHINING A LIGHT MAKES DIFFERENCE: IMPROVED SURVIVAL FROM OUT OF HOSPITAL CARDIAC ARREST THROUGH A POPULATION BASED DATA COLLECTION AND FEEDBACK STRATEGY Laurie J. Morrison, Cathy Zhan, Sandra Chad, Robert Burgess, Steve Driscoll, Mark McLennan, Blair Bigham, Sheldon Cheskes, Michael Feldman, Michelle Welsford, *Pre-hospital and Transport Medicine Research, University of Toronto, Toronto, Ontario, Canada*

Introduction. Translation of science into practice requires implementation strategies that go beyond training and purchasing new equipment. Many believe that simply reporting outcome data to providers ("shining a light") contributes to quality improvement and improved outcomes. We evaluated the differences in sur-

vival over time after the implementation of an out of hospital cardiac arrest (OHCA) population based registry and feedback mechanism. **Methods.** All OHCA occurring from May 1 2006 to April 30 2007 were entered into a population based data set employing standardized data definitions, point of entry logic checks and abstraction instructions. Web based point of time reports provided Utstein data for each service and pooled regional comparative estimates. Feedback consisted of newsletters and emails to providers and monthly conference calls with directors. Bidirectional communication addressed ways to optimize data capture and target education based on outcomes. Monthly survival rates were compared over time employing the Cochran-Armitage trend test ($p < 0.05$). **Results.** In this region of 3.8 M people there were 70 treated OHCA per 100,000/annum. During the period of study, there were 4532 OHCA of which 2663 (59%) were treated by EMS. Of those treated, 2382 (90%) were adult presumed cardiac cases and the overall survival was 5.08% (121/2382) for all presenting rhythms and 15% (76/498) for cases presenting with ventricular fibrillation (VF). VF survival rose from 12.4% (0–6 months) to 18.2% (7–12 months), $p = 0.03$, while bystander CPR (30%) and response intervals; 6.72 minutess, 3.44 (mean, SD) remained unchanged. There was a linear relationship and a significant increase in monthly survival over 12 months for all rhythms ($p = 0.03$) and VF ($p = 0.03$). 2005 guideline training was completed for most of the 6,000 providers prior to the period of study and new defibrillators or software upgrades were not deployed. **Conclusion.** The OHCA survival rate has significantly improved over a one year period of implementing a regional population based data set and providing feedback, independent of new guideline training and implementation of new defibrillators. This study suggests that there may be a sustained effect on survival through optimizing data flow and delivering quality timely reports to operators and providers.

80. EVIDENCE FOR CIRCADIAN VARIABILITY IN THE FREQUENCY OF OUT-OF-HOSPITAL CARDIAC ARREST Steven C. Brooks, Robert H. Schmicker, Thomas D. Rea, Scott S. Emerson, Tom P. Aufderheide, Daniel P. Davis, Ritu Sahni, Laurie J. Morrison, Gena K. Sears, Denise E. Griffiths, *Sunnybrook Health Sciences Center, Toronto, Ontario, Canada*

Introduction. Several sudden cardiac phenomena demonstrate circadian variability. It is not clear if there is also circadian variability in the frequency and outcome for out-of-hospital cardiac arrest (OHCA). The Resuscitation Outcomes Consortium (ROC) Epistry is a large prospective cohort of OHCA. Hypothesis: The maximum frequency of OHCA occurs in the morning hours. **Methods.** We conducted a prospective cohort

study of all persons suffering OHCA due to presumed cardiac cause and treated by emergency medical services (EMS) from 10 North American sites participating in the ROC between December 1, 2005 and November 30, 2006. The relation between time block (4 arbitrary 6-hour blocks) and survival to hospital discharge was analyzed using multivariate logistic regression adjusting for age, sex, witness status, bystander CPR, time from 911 call to EMS arrival and initial rhythm. **Results.** Of the 8297 EMS-treated OHCA, 4531 (54.6%) were witnessed and 3766 (45.4%) were unwitnessed but treated by EMS. The highest frequency was observed between 0601 and 1200 hours and the lowest during 0001–0600 hours ($p < 0.001$). One thousand two hundred eighty-seven OHCA (15.5%) occurred during the 0001–0600 block, 2461 (29.7%) during the 0601–1200 block, 2,450 (29.5%) during the 1201–1800 block, and 2,099 (25.3%) during the 1801–2400 block. This general pattern of daytime excess was observed regardless of initial rhythm, witness status, gender or location of arrest. In contrast, survival did not vary according to time period. The adjusted odds ratio with 95% CI for survival to hospital discharge (patients in the 0001–0600 time block as reference) was 1.00 (0.88, 1.15) for 0601–1200 hours, 0.99 (0.91, 1.07) for 1201–1800 hours, and 1.00 (0.91, 1.09) for 1801–2400 hours. **Conclusions.** The results of this prospective, population-based cohort study suggests that the frequency of OHCA shows circadian variability with incidence greater during the daytime compared to the night. In contrast, survival was similar regardless of time of day.

81. AN ASSESSMENT OF THE RELIABILITY OF CARDIAC ARREST PREDICTOR AND OUTCOME VARIABLES. **Robert Swor, Patrick Medado, Duane Robinson, Heather Grace, William Beaumont Hospital, Royal Oak, MI, United States of America**

Introduction. Cardiac arrest research is valued in part because variables (Utstein), therapy (ACLS) and outcomes (dead or alive) are well defined. Post event record abstraction is the most common method of data collection yet this method has not been externally validated: **Purpose.** To compare agreement of predictor and outcome cardiac arrest variables obtained by two different methods. **Methods.** We performed a retrospective analysis of two separate datasets of cardiac arrest cases transported during a 15 month period. Data was captured via a postevent telephone debriefing of paramedics by a research associate, using a structured survey tool and was abstracted for a multi-center trial. This data were compared to EMS runsheet data from same cases abstracted as part of an ongoing cardiac arrest registry. Data was abstracted by a single verified abstractor, using Utstein style definitions. Both datasets were collected independently and abstractors for each

method were blinded from the other's results. We calculated descriptive statistics and Kappa for inter-rater agreement of key cardiac arrest predictor variables. **Results.** During the study period there were 121 paired cases matched by study author for comparison. Rates of predictor variables are reported for first telephone interview then runsheet abstraction (mean, 95% CI): Bystander CPR 32.5% (23.1%, 42.6%) vs. 18.2% (10.8%, 27.2%), $K = 0.16$; Witnessed arrest 43.4% (33.1%, 53.8%) vs. 56% (44.5%, 66.7%), $K = 0.42$; Vfib arrest 29.3% (20.2%, 39.2%) vs. 28.1% (19.1%, 38.0%), $K = 0.80$; survive to admit 19.7% (12.0%, 28.8%) vs. 17.2% (10.1%, 26.1%), $K = 0.76$. **Conclusion.** Outcome variables and initial rhythm have excellent agreement between methods of data collection, but Witnessed arrest and Bystander CPR provision show fair to poor agreement. Studies that utilize these variables must develop and define valid methods for their measurement.

82. PUBLIC ACCESS DEFIBRILLATORS: ARE THEY USED BY THE "LAYPERSON" PUBLIC? AN OBSERVATIONAL STUDY FROM DELAWARE. **Patrick Matthews, Diane McGinnis-Hainsworth, Ross Megargel, Craig Durie, Christiana Care Health System, Newark, DE, United States of America**

Objectives. In Delaware, great emphasis has been placed on providing public access defibrillators (PADs) in public locations throughout the state. The goal is that persons without medical background or training can use a PAD when cardiac arrest occurs. Although designed to be used by persons without medical training, many people do have some form of medical training such as nurses, EMT's, paramedics, police officers, or physicians and they are often present in a public arena when cardiac arrest occurs. We sought to investigate the number of times PADs were used throughout the state by true "lay persons". **Methods.** The state office of EMS records the total number of out-of-hospital cardiac arrests annually and whether or not PAD was utilized. The state also records whether the PAD was used by someone with medical training or true "laypersons." EMS Data recorded from years January 2004 to June 2007 was examined to determine the number of times PADs were used. **Results.** In 2004, there were a total of 1,465 out-of-hospital cardiac arrests. Of these, 388 had external defibrillators applied. PADs were applied a total of 12 times, 0 of which were applied by laypersons (0%). In 2005, there were a total of 1,423 out-of-hospital cardiac arrests. Of these, 366 had external defibrillators applied. PADs were applied a total of 8 times, 1 of which was applied by a layperson (12.5%). In 2006, there were a total of 1,410 out-of-hospital cardiac arrests. Of these, 373 had external defibrillators applied. PADs were applied a total of 16 times, 2 of which were applied by laypersons (12.5%). In the first half of 2007,

there were a total of 737 out-of-hospital cardiac arrests. Of these, 177 had external defibrillators applied. PADs were applied 4 times, 0 of which were applied by laypersons (0%). Total number of PADs applied from January 2004 to June 2007 was 40, with 3 being applied by laypersons (7.5%). **Conclusions.** Of the total PADs applied in Delaware from January 2004 to June 2007, only 7.5% were applied by lay persons. The root cause of low rate of use of PADs by laypersons requires further investigation.

83. FACTORS AFFECTING DECISION TO TRANSPORT CARDIAC ARREST PATIENTS IN A LARGE URBAN/SUBURBAN PARAMEDIC EMS SYSTEM. **Charles E. Cady, Andrew Cardoni,** *Medical College of Wisconsin, Milwaukee, WI, United States of America*

Purpose. Termination of resuscitation in the pre-hospital setting is becoming the standard. In the last several years more systems have instituted protocols with specific criteria to qualify patients for termination of resuscitation. In our system, patients are generally not transported without a pulse. The purpose of this study was to determine if our providers use consistent self-developed criteria for termination in the absence of a formal set of criteria beyond pulselessness. **Methods.** Retrospective analysis of all non-traumatic cardiac arrests from 1995 to 2005 in an urban/suburban county based paramedic system serving a population of approximately one million. Patients transported and not transported without a return of spontaneous circulation were compared for demographics, treatment including bystander CPR, witnessed arrest, and response time. Chi square ($p=.05$) was used to analyze differences. **Results.** 8,674 adult and 394 pediatric nontraumatic cardiac arrest patients were treated. Of the adults, 5,424 had no ROSC. 708 (13%) of those were transported. Those transported were more likely to have been arrests witnessed by EMS, arrests that occurred in a public place, or arrests with ventricular fibrillation. However, the majority of patients even in these groups were still not transported if they had no pulse. For adult patients, demographics, weight, response time, airway success, and IV success were no different between the groups. Of the pediatric patients, 233 (59%) were transported. **Conclusion.** In our system, while there were significantly more patients with ventricular fibrillation, witnessed arrests, and arrests occurring in public transported without a pulse, the only criteria used the majority of the time to decline a termination of resuscitation in a patient without a pulse was being a pediatric patient.

84. GENDER DISPARITIES IN THE RATE OF BYSTANDER CPR. **Jaime Massucci, Diane McGinnis-Hainsworth, Debra Resurreccion, Ross Megargel,**

Robert E. O'Connor, *Christiana Care Health System, Newark, DE, United States of America*

Purpose. Disparities in health care are widely documented. We conducted this study to test the hypothesis that there is a difference in bystander CPR when the victim of out of hospital cardiac arrest (OOHCA) is classified by gender. **Methods.** The Emergency Medical System (EMS) in the state of Delaware uses a two-tiered response of first responders/basic life support followed by paramedics. All calls are handled by an emergency call center which provides pre-arrival instructions including CPR prompts to the lay person. All OOHCA that were treated by paramedics by our system from 2004 and through July 2007 were evaluated. Demographic data information and time of day was collected on all patients. Time intervals from emergency call receipt to BLS and paramedic arrival were recorded. EMS noted race, age, and gender, and whether or not bystander CPR was being performed on their arrival. Statistical testing included chi-test analysis. **Results.** In 2004, a total of 707 patients in cardiac arrest were studied with 331 classified as female and 376 male. The proportion of patients receiving bystander CPR was 37% females and 17% males ($p < 0.0001$). Census data from 2004 indicates that number of cardiac arrests per 1,000 was 1.103 females and 1.824 males. Through July 2007, a total of 521 patients in cardiac arrest were studied with 192 classified as female and 329 classified as male. The proportion of patients receiving bystander CPR was similar for females (41%) and males (43%). **Conclusions.** Significant gender disparities in the frequency of bystander CPR have existed in the past, but have disappeared over the last 3 years. In the past the public may have been less willing to initiate bystander CPR in males. However, increased public awareness and education seems to have been efficacious in eliminating the gender differences in bystander CPR performance. These findings have important implications for the continued focus on public education and CPR training for all.

85. EARLY POST-RESUSCITATION LEVELS OF CYTOCHROME-C AND INTERLEUKIN-6 AFTER PROLONGED PORCINE CARDIAC ARREST. **David D. Salcido, Eric S. Logue, Brian P. Suffoletto, Jon C. Rittenberger, James J. Menegazzi,** *University of Pittsburgh, Pittsburgh, PA, United States of America*

Background. The identification of serum biomarkers of ischemic injury could provide a means of assessing interventions designed to limit reperfusion injury after return of spontaneous circulation (ROSC). We sought to characterize the early post-ROSC time-course of two candidate biomarkers of ischemic injury (cytochrome-c and IL-6) in a swine model of

ventricular fibrillation (VF). We hypothesized that these two biomarkers would be elevated immediately after ROSC. **Methods.** Twenty-five mixed breed domestic swine were anesthetized and instrumented with ECG, temperature probe, and aortic and right atrial pressure transducers. VF was induced with a transthoracic shock and untreated for 8 minutes. Then mechanical CPR was done for 2 minutes, before drugs were given (epinephrine, vasopressin, propranolol, and sodium bicarbonate) with 3 additional minutes of CPR (first defibrillation attempt at 13 minutes of VF). Blood samples were drawn at the end of instrumentation, and at 20, 40, and 60 minutes after ROSC. Samples were centrifuged and serum extracted. Cytochrome-c was analyzed via Western immunoblotting. IL-6 was analyzed with ELISA. **Results.** No cytochrome-c was detected in any animal, at any timepoint through 60 minutes. IL-6 was similar to baseline levels through 40 min, but was 121% of baseline at 60. **Conclusions.** Neither biomarker was elevated immediately after ROSC. Mitochondrial damage (as indicated by the absence of cytochrome-c) may be delayed by as much as an hour after ROSC, hinting at a possible therapeutic window for interventions like hypothermia. Likewise, inflammatory cascades (as indicated by IL-6) may not begin immediately post-ROSC period, but may by one hour.

86. INDUCING HYPOTHERMIA DURING RESUSCITATION IMPROVES RETURN OF SPONTANEOUS CIRCULATION IN PROLONGED PORCINE VENTRICULAR FIBRILLATION. James J. Menegazzi, Jon C. Rittenberger, Brian P. Suffoletto, Eric S. Logue, David D. Salcido, Lawrence D. Sherman, University of Pittsburgh, Pittsburgh, PA, United States of America

Introduction. Induced hypothermia has been shown to improve survival and neurologic outcomes for ventricular fibrillation (VF) cardiac arrest. Clinical studies have not begun inducing hypothermia until after return of spontaneous circulation (ROSC). The effects of cooling during the resuscitation are not well-studied. **Hypothesis:** We hypothesized that inducing hypothermia at the start of resuscitation would increase the rates of ROSC and short-term survival (20 minutes) in an established porcine model of prolonged VF. We compared intra-resuscitation hypothermia (IRH) with a normothermic control group (CTL). **Methods.** We anesthetized and instrumented 28 domestic swine (mean mass 26.5 ± 2.4 kg) with ECG, esophageal temperature, and micromanometer-tipped aortic and right atrial catheters. We then randomly assigned them to IRH and CTL groups ($n = 14$ each). VF was electrically induced and untreated for 8 minutes. Then resuscitation was begun with mechanical chest compression and ventilation. Hypothermia was induced by rapid IV infusion of ice-cold normal saline (30 mL/kg) at the

beginning of resuscitation in the IRH group. The CTL group got 30 mL/kg of body-temperature saline at the start of resuscitation. After 8 minutes of VF, 2 minutes of CPR was followed by delivery of drugs (epinephrine 0.1 mg/kg, vasopressin 40 U, and propranolol 1.0 mg) and 3 more minutes of CPR (first rescue shock at 13 minutes of VF). ROSC (systolic BP above 80 mmHg for 1 minute continuously) and survival were recorded, as was total fluid given and hematocrits. Temperatures are reported in degrees C. Rates were compared with two-tailed Fisher's exact test, with $\alpha = 0.05$. **Results.** Baseline temperatures at 8 minutes VF did not differ (IRH = 37.9 and CTL = 37.7 degrees). Post-infusion temperatures at 13 minutes of VF were IRH = 34.9 and CTL = 37.9 degrees. ROSC occurred in 12/14 (86%) IRH animals and in 6/14 (43%) CTL, with $p = 0.046$. Survival occurred in 8/14 (57%) IRH animals and 4/14 (36%) CTL, with $p = 0.15$. Total fluid volumes given and hematocrits did not differ between groups. **Conclusions.** IRH doubled the rate of ROSC compared to CTL. There was a nonsignificant 58% relative improvement in short-term survival. In this porcine model, rapid infusion of ice-cold saline quickly cooled during resuscitation.

87. ELECTRICALLY INDUCED CHEST CONSTRICTIONS PRODUCE VENTILATION AS WELL AS CARDIAC OUTPUT Hao Wang, Wanchun Tang, Min-shan Tsai, Shijie Sun, Yongqin Li, Jun Guan, Byron L. Gilman, Max Harry Weil, Weil Institute of Critical Care Medicine, Rancho Mirage, CA, Palm Springs, CA, United States of America

Background. Previous studies have reported that an electrical cardiopulmonary resuscitation (ECPR) method using transthoracic stimulation pulses in the range of 200 V produces coronary and cerebral perfusion during ventricular fibrillation (VF) comparable to Manual Chest Compressions (MCC) in a porcine model of cardiac arrest. Earlier reports show that precordial compressions and spontaneous gasping produced significant airflow during MCC. The present study investigated efficacy ECPR in producing ventilation adequate for resuscitation following Cardiac Arrest. **Hypothesis.** We hypothesized that ECPR may be effective in producing threshold levels of airflow comparable to those produced by MCC following short intervals of untreated Ventricular Fibrillation (VF). **Methods.** In 2 domestic male pigs weighing 40 ± 2 kg, VF was electrically induced and untreated for 10 seconds. Animals were then randomized to receive either ECPR or MCC. ECPR or MCC was applied for 90 seconds or until the Coronary Perfusion Pressure (CPP) fell below 15 mmHg, whichever occurred first. Experimental data to determine CPP, Peak Airflow Rate (PAR) and End Tidal CO₂ (ETCO₂) were recorded. **Results.** For MCC ($n = 4$) we observed mean CPP of 23 ± 3 mm Hg, PAR of 50 ± 8 L/min and ETCO₂ of 14 ± 6 mmHg. Similarly for ECPR

(n = 16) we observed CPP of 21 ± 3 mmHg, PAR of 46 ± 16 L/min and EtCO₂ of 19 ± 4 mmHg. These observed values for ECPR are equivalent to those of MCC to a equivalence $\hat{a} \dagger$ of 5.0 (p = 0.006) for CPP, 10 (p = 0.003) for PAR and 5 (p < 0.001) for ETCO₂. **Conclusion.** ECPR was effective in the production of levels of CPP, ventilation and EtCO₂ comparable to that produced by MCC following a short interval of untreated cardiac arrest. Further study is needed to show efficacy of ECPR as a replacement for early CPR to treat sudden cardiac arrest.

88. DECLINING PROPORTION OF SHOCKABLE RHYTHMS IN OUT-OF-HOSPITAL CARDIAC ARRESTS IN AN URBAN EMS SYSTEM. **Ryan B. Hunt, Claire McNeil, Casey M. Rebholz, Patricia M. Mitchell, Peter Moyer,** *Boston University School of Medicine, Cambridge, MA, United States of America*

Objective. To calculate the proportion of shockable rhythms [ventricular tachycardia (VT) and ventricular fibrillation (VF)] in patients with out-of-hospital cardiac arrest (OOHCA) and to examine the association of age and gender with changes in the proportions of these rhythms. **Methods.** This was a retrospective analysis of Boston Emergency Medical Services' (BEMS) cardiac arrest registry. BEMS is a two-tiered third service urban EMS system with first responder AED. BEMS receives >100,000 911 calls/year and serves a population of 590,763. Included were OOHCA of cardiac etiology from 2003 to 2006. Excluded were non-viable cardiac arrests with presumed medical or traumatic etiologies. Shockable rhythms included all cases with a documented shocked arrhythmia. The Cochran-Armitage trend test (SAS 9.1) was used. **Results.** During the overall study period, there were 400 shockable rhythms out of 1075 OOHCA (37.2%). Of all OOHCA, 66.7% were male, and the median age was 66 years. The median age of women was 71 years, whereas the median age of men was 63 years. The proportion of shockable rhythms in women and men was 28.2% (101/358) and 41.7% (299/717), respectively. Men constituted 74.8% (299/400) of the shockable rhythms. The proportion of shockable rhythms for total subjects decreased significantly (p < 0.001) over the study period [2003: 46.4% (122/263); 2004: 38.8% (107/276); 2005: 34.8% (95/273); 2006: 28.9% (76/263)]. Among women, the proportion of shockable rhythms decreased significantly (p < 0.0001) [2003: 41.5% (39/94); 2004: 29.6% (26/88); 2005: 24.7% (23/93); 2006: 15.7% (13/83)], as they did in men (p < 0.01) [2003: 49.1% (83/169); 2004: 43.1% (81/188); 2005: 40% (72/180); 2006: 35.0% (63/180)]. Among those with shockable rhythms, the proportion of men increased significantly (p < 0.03) [2003: 68.0% (83/122); 2004: 75.7% (81/107); 2005: 75.8% (72/95); 2006: 82.9% (63/76)]. **Conclu-**

sions. Over the four year period, there was a statistically significant decrease in the proportion of shockable rhythms, which is consistent with previously reported trends. Additionally, the absolute change in proportion of shockable rhythms was substantially greater for women than for men. Further investigation is needed to examine factors associated with the overall declining proportion and specifically the decline for women.

89. IMPROVED SURVIVAL TO DISCHARGE IN CARDIAC ARREST PATIENTS USING A NOVEL OUT-OF-HOSPITAL PROTOCOL **Alex Garza, Matthew Gratton, Joseph Salamone, III, Daniel Lindholm, James McElroy, Rex Archer,** *Washington Hospital Center, Falls Church, VA, United States of America*

Cardiac arrest continues to have poor survival in the U.S. despite wide distribution of AED's to out of hospital providers. Recent studies in time dependent myocardial responsiveness to therapy, myocardial perfusion in post arrest patients, and effect of ventilation, question current practice in resuscitation. Our EMS system made significant changes in the adult cardiac arrest resuscitation protocol, including minimizing chest compression disruptions, using a 50:2 compression ventilation ratio, deemphasizing and delaying intubation, and performing an aggressive round of chest compressions before initial counter-shock. Treatment protocols prior to these changes were consistent with the Advanced Cardiac Life Support (ACLS) algorithm. **Methods.** Setting: Midwest, urban, Public Utility Model, all ALS ambulance service with AED equipped BLS fire department first response. Design: Retrospective, observational, cohort study reviewing all adult primary, witnessed cardiac arrests with an initial rhythm of ventricular fibrillation 39 months pre-protocol change (pre-c) and 12 months post-protocol change (post-c). The outcome of interest was survival to discharge from the hospital. Analysis: Chi Square analysis was performed and Relative Risk with 95% CI were calculated. P value less than 0.05 was considered significant. **Results.** There were 1096 primary cardiac arrest patients of which 150 met the inclusion criteria in the pre-c cohort with 32 (21.3%) patients surviving to discharge. There were 339 cardiac arrest patients of which 52 met inclusion criteria in the post-c cohort. Of these, 23 (44.2%) survived to discharge. There was a significant increase in survival to discharge in the post-c cohort ($\chi^2 = 7.07$, p < 0.01, RR, 1.82, 95% CI: 1.19-2.00). **Conclusion.** The changes to our pre-hospital protocol for adult cardiac arrest optimized chest compressions and reduced disruptions for intubation and ventilation and required compressions before a single counter-shock producing significant increases in survival to discharge in our patient population. These changes should

be considered for improving survival of out of hospital cardiac arrest patients.

90. SAFETY EVALUATION OF A PREHOSPITAL CARDIAC ARREST REGIONALIZATION PROTOCOL FOR PATIENTS WITH RETURN OF SPONTANEOUS CIRCULATION IN THE FIELD Bentley J. Bobrow, Tyler F. Vadeboncoeur, Daniel W. Spaite, Vatsal Chikani, Lani Clark, Arthur B. Sanders, Mayo Clinic Arizona, Scottsdale, AZ, United States of America

Objective. There is good evidence that therapeutic hypothermia (TH) improves neurological outcomes for prehospital cardiac arrest (PCA). Yet, TH is used in less than 10% of hospitals for comatose survivors of cardiac arrest. Regionalizing post-resuscitation care for PCA patients with return of spontaneous circulation (ROSC) to facilities that provide TH might increase the rate of neurologically intact survivors. We applied a theoretical prehospital bypass protocol to our statewide PCA database to assess the safety of potentially bypassing the closest hospital with comatose, ROSC patients and transporting them to a designated regional cardiac arrest center (RCAC). **Methods.** Data from an Utstein style-compliant registry of PCA patients that captures approximately 70% of Arizona's population were evaluated (October, 2004-December, 2006). We evaluated the association between EMS transport interval (TI-depart scene to ED arrival) and survival to hospital discharge in all adult, non-traumatic PCA patients and in the subgroup of patients who achieved ROSC but remained comatose. **Results.** 1846 PCAs were adult, of cardiac etiology and with the arrest occurring prior to EMS arrival. Complete TI data were available for 1177 PCAs with 70 (5.9%) surviving to hospital discharge. 253/1177 (21.5 %) achieved ROSC and remained comatose (meeting criteria for bypass protocol) with 43 (17.0%) surviving. Mean TI for all PCAs was 6.9 minutes (95% CI: 6.7-7.1). Logistic regression revealed multiple factors that were strongly associated with survival: Witnessed arrests, bystander CPR, and decreased EMS response interval (dispatch to scene arrival). This analysis, after controlling for confounding factors, revealed no significant association between TI and survival (odds ratio 1.2, 95% CI: 0.7-1.8). Similar results were found for the comatose, ROSC sub-group (OR 1.0, 95% CI: 0.5-1.9). **Conclusion.** In our statewide database, survival of adult PCA patients did not significantly decrease with an increase of the TI. This suggests that a modest increase in TI due to bypassing the closest hospital to transport eligible patients to a RCAC is safe and warrants further investigation.

91. CARDIAC ARREST OF NON-PATIENTS WITHIN PUBLIC HOSPITAL AREAS Robert Jones, Jr., Roxana Delgado, Bruce D. Adams, San Antonio Uniformed Ser-

vices Health Education Consortium (SAUSHEC), Ft Sam Houston, TX, United States of America

Purpose. Determine the demographics, trends, response to and outcomes of cardiac arrest among visitors in public areas of hospitals. **Background.** Cardiac arrests can occur to visitors or staff within a hospital's public areas such as parking lots, outpatient clinics, lobbies or restaurants. The limited research on this topic found delayed medical responses and excess mortality in this unique cohort **Methods.** We queried the National Registry of Cardiopulmonary Resuscitation (NRCPR) and focused on all visitor cardiac arrest victims between Jan 2000 and May 2006 utilizing standardized Utstein parameters. We excluded pediatric patients. We compared this cohort to NRCPR inpatients (case control) matched for age, gender, race and presenting rhythm for outcomes. **Results.** There were a total of 65,536 hospital arrests with 135 (0.21%) occurring to visitors in public areas of the hospital. The average age of the visitor cohort was 65.0 years; 40.0% were female; race = 76.2% white, 14.1% black, 9.6% other. The leading presenting rhythms were asystole (22.9%); pulseless electrical activity (19.5%); ventricular tachycardia (7.6%), ventricular fibrillation (46.6%). Return of spontaneous circulation trended higher in the visitor cohort (57.0% vs. 49.8%, $p = 0.11$). Survival at 24 hours (50.4% vs. 34.9%, $p < 0.001$) and to hospital discharge (43.7% vs. 17.0%, $p < 0.001$) was significantly higher in the visitor cohort. **Conclusions.** Hospital staffs should establish procedures with local EMS or be prepared to respond swiftly to a cardiac arrest of visitors within public areas of a hospital. Automated external defibrillators may improve response times and ultimately the clinical outcomes.

92. AMBULANCE STRETCHER ADVERSE EVENTS Henry E. Wang, Benjamin N Abo, Matthew Weaver, Robert Kaliappan, University of Pittsburgh, Pittsburgh, PA, United States of America

Introduction. Emergency Medical Services (EMS) personnel regularly use wheeled ambulance stretchers to move patients in the out-of-hospital setting. Despite their frequent use, intricate mechanisms and operational complexities, only limited reports describe adverse events associated with ambulance stretcher operation. We characterized the nature of and injuries resulting from ambulance stretcher adverse events. **Methods.** We used data from the United States Food and Drug Administration's Manufacturer and User Facility Device Experience Database (MAUDE), which contains mandatory and voluntary reports of medical device adverse events. We identified all adverse events involving wheeled ambulance stretchers during the years 1996-2005. We excluded hospital and

non-wheeled stretchers, stair chairs and other patient handling devices. Using structured data review, we identified the nature of the adverse event, the method of stretcher handling during the incident, the individuals injured and the resulting injuries. We analyzed the data using descriptive statistics, including binomial proportions with exact 95% confidence intervals. **Results.** Of 671 adverse events involving wheeled ambulance stretchers, the most common incidents were stretcher collapse (54%; 95% CI: 50–57%), broken, missing or malfunctioning part (28%; 25–32%), and dropped (7%; 5–9%) or tipped stretchers (4%; 3–6%). Method of handling during the incident was reported for 204 events and included unloading stretcher from ambulance (53%; 95% CI: 46–60), moving the stretcher (14%; 9–19%), adjusting stretcher height (10%; 6–15%), moving patient on/off stretcher (9%; 5–14%) and loading stretcher onto ambulance (8%; 5–13%). Injuries occurred in 121 of 671 events (18%; 95% CI: 15–21%), including sprains or strains (29%; 22–38%), fractures (16%; 10–24%), lacerations or avulsions (13%; 8–20%), contusions or abrasions (4%; 1–8%), traumatic brain injury (2%; 1–7%) and death (2%; 1–7%). Of the injury events, EMS personnel were harmed in 53% (95% CI: 44–62%), and patients were harmed in 43% (34–52%). More than one individual was injured in 10% (95% CI: 5–17%). **Conclusion.** Ambulance stretcher adverse events most often involve stretcher collapse, commonly occur during unloading from the ambulance, and frequently result in significant injury to patients and EMS personnel. Design and training improvements could enhance EMS patient and provider safety during ambulance stretcher operation.

93. PHYSICIAN PROVIDED PREHOSPITAL CARE-REDUCING THE BURDEN ON EMERGENCY DEPARTMENTS Cathal O'Donnell, Conor Deasy, Damien Ryan, *Mid-Western Regional Hospital, Limerick, Ireland*

Introduction. Physician provided prehospital advanced life support (ALS) in Ireland is currently provided by a small number of general practitioners and emergency department (ED) based response teams. Paramedic provided ALS was recently introduced but is not yet widely available. **Aims.** 1) To maximise the level of care given to patients in the field and 2) to identify patients not requiring ambulance transfer to an ED. **Methods.** An EMS based physician provided response team was initiated. This involved a senior emergency medicine trainee (roughly equivalent to chief resident) and a paramedic responding to 999 (equivalent to 911 in North America) calls via rapid response vehicle. The physician administered any and all treatment required in the field prior to and during transport, as well as determining if patients did not require transport to hospital. This service was provided one day per week. **Re-**

sults. 143 patients were seen over 26 non-consecutive days between July 2004 and May 2005. 87 (60%) of these were male. The age range was from 8 weeks to 89 years. Presentations seen included; motor vehicle crash (21%) collapse (18%), fall (12.5%) and seizure (10%). There were 4 cardiac arrests. The majority of calls were to houses (36%). The most common medical intervention was intravenous cannulation (43%). Intravenous medications were administered in 21% of these patients; morphine sulfate was the most common drug given. Four patients were intubated at scene as part of advanced cardiac life support but were pronounced dead on arrival to the ED. It was possible to safely discharge one quarter of patients on scene. Of these 36% had motor vehicle crash induced minor soft tissue injuries and 22% had alcohol induced problems. This led to a cost saving €9072 (approx \$12,240) based on avoidance of unnecessary ambulance trips and non attendance at EDs. **Conclusion.** One quarter of patients attended to were treated and discharged from medical care in the field, avoiding transport to hospital. This resulted in a reduction in the patient burden on our city's overcrowded emergency departments, a significant cost saving to our health system as well as the avoidance of the inconvenience of an emergency department visit.

94. SAFETY AND CRASHWORTHINESS ENGINEERING ANALYSIS OF THE AMBULANCE MANUFACTURING DIVISION'S PROPOSED 2007 AMBULANCE STANDARDS Nadine Levick, Raphael Grzebieta, *EMS Safety Foundation, New York, NY, United States of America*

Introduction. USA ambulances are built by aftermarket ambulance manufacturers, to meet the Ambulance Manufacturing Division's (AMD) own design standards. These standards are essentially developed outside automotive safety and crashworthiness engineering oversight. **Objective.** To analyze the safety engineering and crashworthiness validity of the AMD standards. **Methods.** Proposed 2007 AMD standards 001-025 were analyzed by a multidisciplinary automotive safety and crashworthiness engineering and EMS team, via application of basic engineering principles of crashworthiness, published technical crashworthiness and injury mitigation literature, available crashworthiness testing data and with a focus on potential for reducing harmful loading and potential for injury causation in crashes or sudden decelerations. **Results.** There was no dynamic or impact crashworthiness testing required or mentioned to demonstrate safety performance at all. The testing outlined was static testing only, with no acceleration. Force = Mass x Acceleration, thus no inertial forces are described in the standard. Potential head strike zones were inaccurate, with known head strike zones specifically excluded. Anchorages for

seat belts or equipment lockdowns or brackets were not required to be anchored into crashworthy structural components. There was no demonstrated patient compartment structural crashworthiness. Claims that successful testing reduced "the possibility of injuries and fatalities"... "encountered in crashes or adverse forces that can result from a vehicle impact", were not supported by any technical data, injury criteria or thresholds and were in conflict with accepted, existing established technical science. No referenced scientific technical literature from Newton onwards. These standards were not consistent with accepted, established technical scientific approaches to vehicle safety, occupant protection or safety performance. **Conclusion.** Ambulance design is a vehicle and automotive safety engineering issue and is a technical field of expertise outside of EMS practice. The development of the AMD design standards appears to be well outside of accepted automotive and crashworthiness safety technical data, practice and expertise. Use of this standard has potential liability risks for manufacturers, given apparent lack of awareness of accepted vehicle crashworthiness test procedures. The AMD should consider revising the standard comprehensively to reflect current accepted automotive safety practice, given the current vehicle crashworthiness and occupant protection knowledge and published literature.

95. A COMPARISON OF HOSPITAL COSTS AFTER SUCCESSFUL CARDIAC RESUSCITATION COMPARED TO STEMI PATIENTS. **Robert Swor, Judy Boura, Scott Compton, Victoria Lucia, William Beaumont Hospital, Royal Oak, MI, United States of America**

Introduction. Care provided to patients that survive initial resuscitation after out of hospital cardiac arrest is sometimes viewed as expensive and a poor use of societal resources. **Objective.** To compare total hospital cost and length of stay (LOS) of patients resuscitated from out of hospital cardiac arrest (OOHCA) compared to ED patients with ST segment elevation MI (STEMI). **Methods.** We performed a retrospective review of a cohort of patients who were resuscitated after OOHCA and admitted to single academic hospital from the period 2001–2005. To try and place OOHCA patients survivors into context, subjects were compared to all patients arriving in the ED during 2003–2005 with a STEMI. Total hospital costs and hospital length of stay were obtained from hospital cost accounting. **Results.** During the study period, there were 68 OOHCA patients who were initially resuscitated. Fifteen were excluded due to missing financial data. Complete financial (direct + indirect costs) and clinical data is available for 31 OOHCA. All 402 STEMI patients had complete clinical and financial follow-up information. The OOHCA and STEMI groups were similar for age, gen-

der, or insurance type. Overall 24 (45.3%) of OOHCA patients and virtually all (96.3%) STEMI patients survived to hospital discharge. LOS approached significance between OOHCA and STEMI patients (median 6 vs. 4 days Wilcoxon Rank Test, $p = 0.06$). Most OOHCA and STEMI patients were hospitalized for <7 days (62.3% vs. 81.1%, $p < 0.002$) and few (3.8% vs. 5.7%, $p = 0.75$) were discharged to extended care facilities (ECF). For those patients with complete financial data, total hospital costs for OOHCA patients were greater than for STEMI patients (median \$26,940 vs. \$18,528, Wilcoxon Rank Test, $p = 0.002$). **Conclusion.** As expected, resuscitated OOHCA patients have a lower survival rate than STEMI patients and incurred greater hospital costs. However, given the low frequency of these events, the short length of stay for the majority of OOHCA patients, and low rate of discharge to an ECF, these direct costs do not appear to pose a significant societal cost burden. Further work is needed to understand the true societal costs of cardiac resuscitation.

96. A QUICK AND EASY DETERMINATION OF EXTERNAL BLOOD LOSS USING THE 'MAR METHOD' **Mark A. Merlin, Scott Alter, Brian Raffel, Ron Cody, Robert Levy, Robert Wood Johnson Medical School, Livingston, NJ, United States of America**

An element lacking in all levels of medical training is the ability to estimate blood volumes. Because of this, emergency health care workers currently use visual estimation as their only means of determining blood volumes, which has shown to be highly inaccurate. This study proposes and tests a new method using one's fist to determine external blood loss. In a controlled setting, known increments of human whole blood were measured and used to compare fist size to surface area of blood present. A formula was created averaging blood per fist, hereafter known as the MAR Method. Two scenarios were staged using set qualities of blood (75 mLs and 750 mLs). Both EMS and hospital personnel were asked to visually estimate the volume present in both scenarios. Participants were then taught the MAR Method in a brief session, lasting less than one minute. They were given an additional opportunity to utilize the new method to again estimate the blood volumes. Errors in volume estimation were calculated and compared before and after using the MAR Method. Based on eight trials using known volumes, the MAR Method was created where one fist covers a surface area of blood that is 20 mLs. 74 participants with various areas of training and years of experience estimated blood volumes in the two scenarios. Initial guesses had errors of 120.4% and 73.1% for the small and large pools, respectively. Using the MAR Method reduced errors in estimation occurred. For the smaller volume, the average error from the mean reduced by 76.7% ($p < 0.0001$) and

the Interquartile Range of errors reduced by 60%. For the larger volume, the average error from the mean reduced by 40.5% ($p < 0.0001$) and the Interquartile Range of errors reduced by 42.8%. Medical personnel do not receive formal training in blood loss determination, and as a result, are unable to accurately estimate blood volumes. A method was created to improve blood volume determinations. After short instruction of the MAR Method, participants were able to determine blood volumes with improved accuracy and precision. This is first such description in the literature.

97. SIMULATED RESCUE AIRWAY USE BY LAYPERSONS WITH TELEPHONIC INSTRUCTION **Gillian Beauchamp, Paul Phrampus, Francis X Guyette, III,** *University of Pittsburgh, Pittsburgh, PA, United States of America*

Background. The King LT is a supraglottic airway with the potential for use by both the lay rescuer and the trained first responder in settings where access to medical interventions by a physician or Emergency Medical Services may be delayed. Additionally, the ability of first responders or lay persons to employ the King airway in conjunction with CPR/AED is unknown. **Objectives.** To determine the success rate of untrained rescuers in the telephone-directed placement of the King LT supraglottic airway device for use with bag valve assisted ventilation during a simulated respiratory arrest. **Methods.** A prospective study using a high fidelity human simulator was conducted using 30 undergraduate students without medical training. Subjects were instructed using a telephone-directed protocol to assess level of consciousness, airway and breathing. The subjects were then instructed to place the King LT and begin ventilating the simulator. Subjects were assessed on the successful placement of the King LT device, time to placement, and perceived ease of use of the device. A five point Likert scale was used to identify subject comfort level with the procedure. Subjects with CPR/AED certification were compared to those without such training. Data were analyzed by descriptive statistics and Fisher's exact test was used for comparison analyses. **Results.** 30 subjects participated. 67% are female and 30% had some CPR training. None had any medical training beyond CPR/AED. The King airway was successfully placed in 80% (95% CI: 65-95) of attempts. Success rate did not differ with prior CPR training. The median time to successful placement was 1 minute 50 seconds (95% CI: 1 minute 6 seconds; 2 minutes 39 seconds). The subjects were only given one attempt to place the device. The participants perceived the King LT to be easy to place in 90% (27/30) of cases. **Conclusions.** The King LTD can be successfully placed by lay rescuers with minimal telephonic instruction. In instances where access to the EMS system may be de-

layed, the King LTD may represent an alternative to non-invasive ventilation or no ventilation.

98. ATROPINE PRETREATMENT IN PEDIATRIC AIR MEDICAL RSI. **Brian D. Clothier, Eric Swanson, Scott McIntosh,** *University of Utah, Salt Lake City, UT, United States of America*

Background. Atropine pretreatment has been recommended for children prior to rapid-sequence intubation (RSI). Limited data exist on compliance with these recommendations in the transport setting. **Objectives.** To determine what percentage of children receive atropine in out-of-hospital RSI in compliance with a pre-established protocol. We also investigated if the absence of atropine administration correlated with subsequent bradycardia. **Methods.** We conducted a retrospective review of a consecutive series of pediatric patients at a university-based air medical transport program from January 1, 1995 through May 30, 2007. Transport records and prospectively gathered airway management quality assurance data were reviewed for all pediatric patients who received RSI by the air medical transport team. Cases were reviewed to determine if atropine was administered according to predetermined guidelines. Logistical regression and Fisher Exact Test were used for data analysis. Exclusion criteria were patients greater than ten years of age and those intubated prior to arrival of the transport team. Outcome measures included the percentage of children pretreated with atropine and incidence of bradycardia. Bradycardia was defined using APLS guidelines. Bradycardia present prior to administration of succinylcholine or airway manipulation was not attributed to RSI. **Results.** 39 patients met inclusion criteria, 25 of which (64%) received atropine. Appropriate atropine administration was less likely as patients advanced with age (OR = 0.802, $p = 0.071$) but increased by an average of 20.4% each year during the study period (OR = 1.204, $p=0.083$). Only 3 patients experienced RSI-associated bradycardia: 2 had received atropine, 1 had not. The absence of atropine pre-treatment was not associated with bradycardia ($p = 1.000$). **Conclusions.** Air medical transport providers followed guidelines for pre-treatment with atropine prior to RSI only 64% of the time, although compliance improved throughout the study period. Providers were more likely to administer atropine in younger patients. RSI-associated bradycardia is uncommon, and did not correlate with an absence of atropine pretreatment, a point that bears further investigation. This study is limited by the small sample size and the retrospective nature of the study.

99. ERRORS IN PREHOSPITAL ESTIMATION OF PEDIATRIC WEIGHT BASED DOSING **Bryan Yurek, David**

LaCovey, Francis X Guyette, III, *University of Pittsburgh, Pittsburgh, PA, United States of America*

Introduction. Medication errors associated with drug administration to pediatric patients are common and have been demonstrated in various settings including the emergency department, intensive care unit and outpatient clinics. Little data exists on pediatric medication dosing errors associated with prehospital transport. **Objective.** To investigate medication errors that occurs in pediatric patients transported by a critical care air transport service. **Methods.** We conducted a retrospective chart review of all pediatric medication administrations for a critical care transport service during a one-year period. Transports were included if the patient was administered any drug by the flight crew and transported to the primary pediatric hospital. Transports completed by a specialty pediatric team were excluded. Data included the medication type and dose, age, estimated weight, actual weight, absolute error in weight estimation, and percent error of the patient's actual weight as determined by the receiving pediatric hospital. Dosages were considered to be in error if they varied from the actual weight based dose by more than 10%. Weight estimates were considered to have significant error if they varied from actual weights by greater than 10%. **Results.** A total of 174 consecutive, pediatric prehospital charts were reviewed accounting for 482 medication administrations. Patients ranged in age from 1 month to 17 years (mean 9 years [95% CI: 1–16.6]). Dosing errors occurred in 49% (237/482) of medication administrations with the mean percentage error of 12% (95% CI: 0–33.3). The maximum percentage error was 96%. 35% of errors resulted from inaccurate estimation of patient weight. 16% of the charts showed significant underestimation of weight. 20% of the charts showed significant overestimation of weight. 2% of charts had no weight documented. The most common medications administered were analgesics and fluids. There were no deaths. One adverse event associated with the administration of atropine was reported but was not associated with an incorrect dose. **Conclusion.** Incorrect recording or estimation of patient weight frequently leads to medication dosing errors in this subset of prehospital pediatric patients. The observed errors did not result in any adverse events.

100. PREHOSPITAL PAIN ASSESSMENT IN PEDIATRIC TRAUMA **Eugene Izsak, Janet L. Moore, Kathryn Stringfellow, Michael F. Oswanski, David A. Lindstrom, Heather A. Stombaugh**, *The Toledo Hospital & Toledo Children's Hospital, Toledo, OH, United States of America*

Investigators implemented the current study to analyze the documentation of pain assessment and interven-

tion for injured children in prehospital settings. For this IRB-approved retrospective study, 696 Lucas County Emergency Medical Services trauma charts (46% of the county's total runs) from 2002–2004 were reviewed, and descriptive statistics of frequency were used to analyze pain assessment documentation and interventions. Pain was noted in 64.1% (446/696) of subjects and was undocumented in 18.7% (130/696). Only one trauma chart (1/696, 0.2%) indicated the appropriate use of a validated pain assessment tool (Verbal Rating Scale). There were no documented pain interventions provided to 86.6% (603/696) of all subjects, including 85.0% (379/446) with documented pain. Of all subjects, 13.4% (93/696) received pain interventions. Pharmacological interventions were used for 2.2% (15/696) of all subjects and 16.1% (15/93) of subjects with documented pain interventions. Non-pharmacologic interventions were used in 12.4% of cases (86/696), in which traction and splinting were the most common interventions (36/93, 38.7%) followed by saline flushes and ice (15/93, 16.1%). Diversion and distraction techniques were documented in five charts in which a pain intervention was documented (5/93, 5.4%). These study results identify a void in the documentation of pain assessment and implementation of pain control interventions for injured pediatric patients. Education for prehospital providers is recommended, emphasizing the importance of pain assessment and documentation of pain control care for pediatric trauma patients.

101. EMS PROVIDER USE OF THE PEDIATRIC EZ-IO NEEDLE IN PEDIATRIC PATIENTS: A PILOT STUDY **Ralph J. Frascione, Joseph P. Jensen, Sandi S. Wewerka, Joshua G. Salzman** *Regions Hospital EMS, St. Paul, MN, United States of America*

Introduction. The use of pediatric intraosseous access is common practice. We examined provider use of a new intraosseous device (EZ-IO PD[®]) designed for pediatric patients. **Methods.** This prospective pilot study was reviewed and approved by the HealthPartners Research Foundation IRB. The training session consisted of a 30-minute PowerPoint presentation and a hands-on simulated insertion. Following successful training, the EZ-IO PD[®] was deployed for use. Criteria for device usage were: 1) patient weight = 3–39 kg, 2) poor vein selection and/or one or two failed IV attempts, and 3) immediate use of the IO for pediatric cardiac arrest patients. Exclusion criteria were: 1) recent tibia or femur fracture, 2) recent IO attempt at the same site, 3) infection over the insertion site, or 4) inability to identify insertion site landmarks. Following use of the device, a telephone data collection process was completed. Insertion failure or success (insertion of needle into bone with subsequent fluid flow), time to fluid flow, provider comfort with device, device performance

assessment, and recommendation for future use were collected and analyzed. **Results.** Two hundred forty-six EMS providers (EMT-P and RNs) from 14 EMS agencies consented to participation. Fifteen (15) insertions were completed between June 2006 and June 2007. Demographic statistics for patients are as follows: 9 (60%) male, 6 female (40%), mean age = 3.8 years, and 12 (80%) were medical cases. Successful insertion was achieved in 14 of 15 patients (93%, 95% CI = 80–100%). Successful insertion was achieved in < 60 seconds by 10 of 14 providers (71%, 95% CI = 48–95%, 1 non-response). A large majority of providers reported feeling comfortable with the device (86%, 95% CI: 61–100). Thirteen of 14 providers felt the device worked well (93%, 95% CI: 79–100, 1 non-response), and 11 of 14 providers would recommend future use of the device (79%, 95% CI: 57–100, 1 non-response). **Conclusion.** The EZ-IO PD[®] is easy to train and has a high insertion success rate with our provider group. Our EMS providers also feel comfortable using the device and recommend the device for future use.

102. THE EPIDEMIOLOGY OF EMERGENCY MEDICAL SERVICES USE BY CHILDREN: AN ANALYSIS OF THE NATIONAL HOSPITAL AMBULATORY MEDICAL CARE SURVEY **Jeremy T. Cushman, Manish N. Shah, Colleen O. Davis, Jeffrey Bazarian, Peggy Auinger, Bruce Friedman, University of Rochester, Rochester, NY, United States of America**

Objective. To characterize pediatric emergency department (ED) visits arriving by emergency medical ser-

vices (EMS) and identify factors associated with those visits. **Methods.** A secondary analysis of the ED component of the 1997-2000 National Hospital Ambulatory Medical Care Survey using logistic regression analyses was conducted. The dependent variable was the mode of arrival to the ED (EMS vs not EMS), and independent variables were grouped into four domains: demographic, clinical, system, and service characteristics. **Results.** There were 110.9 million ED visits by children ages birth until their 19th birthday between 1997 and 2000. Pediatric patients comprised 27.3% of all ED visits during this time and 7.9 million (7.1%) of these patients arrived via EMS. The annual EMS utilization rate by children was 26 per 1,000 compared to 66 per 1,000 in the adult population. Sixteen percent of children transported by EMS were admitted to the hospital. Sixty-two percent of patients arriving to the ED by EMS were transported as a result of injury or poisoning. Characteristics associated with arrival by EMS included demographic (African American race, urban residence), clinical (need for greater immediacy of care, illnesses affecting the circulatory system, and care related to injury and poisoning), system (lack of insurance), and service (greater number of diagnostic services). **Conclusions.** Pediatric patients represent a small proportion of EMS transports and utilize EMS at a lower rate than adults. Despite this low utilization rate, pediatric patients are transported by EMS more often as a result of injury or poisoning and display a higher acuity illness than those arriving to the ED by other means. The epidemiology of pediatric EMS use may have important operational, training, and public health implications.